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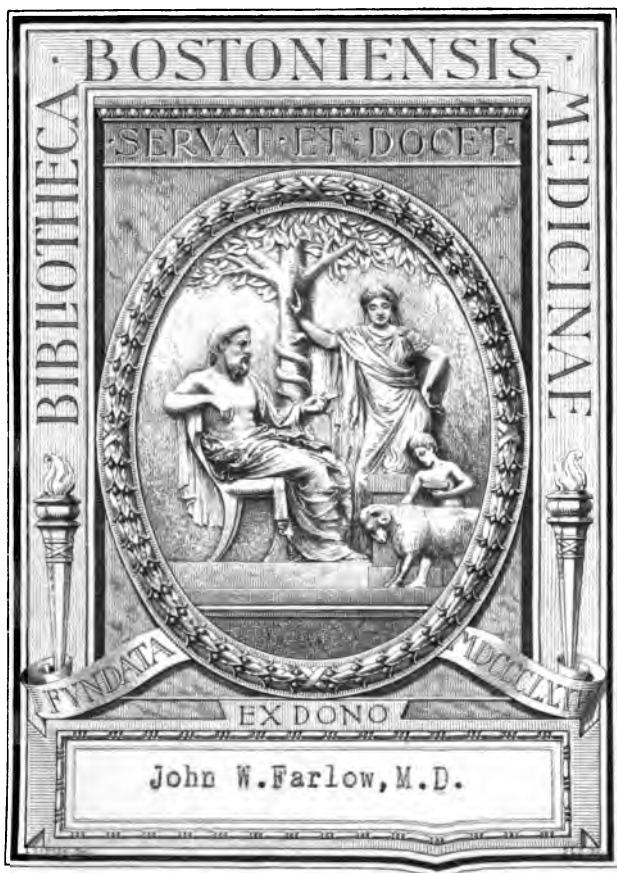
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GUIDE TO THE EXAMINATION

OF THE

THROAT, NOSE, AND EAR

GUIDE

TO THE EXAMINATION

OF THE

THROAT, NOSE AND EAR

FOR

Senior Students and Junior Practitioners

BY

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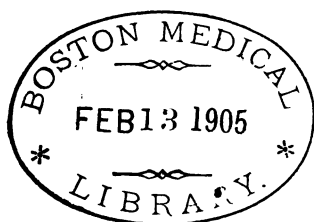
PREFACE

In this little book the writer has aimed at being extremely elementary. He has tried to anticipate the difficulties which the student or young practitioner is likely to meet with when he begins to examine cases of disease of the throat, nose, and ear, and, as far as possible, to simplify them.

In the case of each region a sketch of the normal topography and appearances is first given, and this is followed by a brief outline of the principal alterations from the normal which the student may expect to meet with in the course of his work. A few practical hints on methods of local treatment have been added.

In teaching the elements of any subject some repetition is unavoidable. This is no doubt tedious to the expert reader, but in a book which is only intended for beginners, it is, in the writer's opinion, necessary. He believes thoroughly in the teaching methods of ' Mr. Bixby,' as immortalized by Mark Twain in his ' Mississippi Pilot.'

22, Temple Row,
  Birmingham,
     September, 1904.

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GUIDE TO THE EXAMINATION

OF THE

THROAT, NOSE, AND EAR

I

INTRODUCTORY

THE student who wishes to make a satisfactory exami-
nation of the throat, nose, or ear must first of all acquire
a certain facility in the use of reflected light.   This
is not a difficult matter, but it is not always realized
that it really does take a little time and some practice
before the beginner can be expected to see much.
The mouth and pharynx are, of course, the easiest parts
to examine ; next in difficulty comes the larynx (in
average cases); and, lastly, the nose.   Posterior rhinos-
copy is generally regarded as the most difficult method
of examination.   In troublesome cases it is so, but
when a view is once obtained the interpretation of
the picture is generally comparatively simple, just as
the picture itself is much less complex than that pre-
sented by anterior rhinoscopy.   In examining the
nose from the front the observer looks through a con-
stricted entrance into a narrow cavity of considerable
depth, lined by a dark-red mucous membrane, which

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makes it difficult to light up, and in addition to this most of the structures to be examined are presented to him ' end on,' so that they are seen in perspective, and appear greatly foreshortened.   For these reasons anterior rhinoscopy presents considerable difficulty to the beginner, and a good deal of practice is required before the student can tell with any certainty what he is looking at.   If, however, this method of examination is somewhat difficult to master it is at any rate well worth the trouble, for diseases of the nose are common, troublesome to the patient, and for the most part very amenable to suitable treatment.

As palpation with the finger cannot be practised in the nasal cavity without the use of a general anæsthetic, the student must learn to depend upon inspection and the use of the probe.   Both methods are essential to a complete examination, but neither can be used to much advantage till the student has mastered the initial difficulty of seeing accurately into the cavity.

Aural cases occupy a somewhat different position, inasmuch as inspection and palpation play a smaller part in their investigation.   Chronic suppurative cases offer the greatest difficulty to inspection on account of the enormous variety of appearances presented and the smallness of the field.   In the examination of all three regions it is generally desirable to use artificial light, and a forehead mirror with which to reflect it into the cavity to be examined.   The incandescent gas mantle gives an excellent white light, and it is all the better for being covered by a metal chimney provided with a bull's-eye.   The heat it gives out is the only objection to it.   The best electric lamp the writer has seen is the one described by his colleague, Dr. Wilfred Glegg, in the *British Medical Journal* for

January 9, 1904. It yields a brilliant white light of about 100 candle-power.

It is convenient to use one forehead mirror in examin-ing all three regions. The writer uses an ordinary laryngoscopic reflector of some 12-inch focal distance, and finds it answer perfectly, but it is often recom-mended to use a mirror with a shorter focal distance in examining the nose, and still more the ear, and the beginner may probably find the shorter focus easier to manage. There is a distinct advantage, however, in becoming accustomed to the use of one mirror for all three regions, seeing that they must frequently be examined in succession in the same patient. The reflector is generally worn over the right eye, the observer looking through the hole in the centre so that his line of sight coincides with the centre of the reflected rays. In order to adjust the reflector the student should close his left eye for a few seconds while he focusses the light upon the patient's lips, or anterior nares, or external meatus, as the case may be. A good ball-joint properly adjusted will hold the reflector exactly in position, and it is easily moved if necessary. The light should generally be placed at the patient's left side, level with his ear and a little behind it ; the surgeon's reflector should be as nearly as possible on a level with the light. In some cases (especially nasal cases) it is more convenient to have the light on the patient's right side, as in various manipulations the operator's right hand requires to be raised above the level of his eye, and so interferes with the illumination. When working with the light on the patient's right side it is better for the surgeon to use the left eye in order to shield it from the glare, especially if he be using a very powerful light such as the Nernst or the limelight.

The exact mode of attachment of the reflector to the forehead is a matter of no moment, provided it be firm and comfortable. The writer from long habit prefers the forehead band, with either Schrötter's attachment or the still simpler American lock, but the spectacle frame or the folding steel spring can be made to answer just as well.

It is well to have a systematic method of local exami-nation, but it need not be followed slavishly, and can be varied to suit particular cases ; the essential thing is that no region shall escape examination.

When a definite complaint is made of one particular part—*e.g.,* pain in the ear or throat—it is well to begin with the inspection of that part, and then go on to complete the routine examination ; but when no special order of precedence is indicated it is the writer's habit to proceed as follows :

After noting any obvious external changes such as enlarged glands or other swelling, want of symmetry, etc., he inspects the mouth and pharynx, and then whilst the patient is still fresh proceeds to posterior rhinoscopy. He next examines the nares from the front, and finally the larynx, and if necessary the ears.

EXAMINATION OF THE MOUTH AND PHARYNX, INCLUDING THE NASO-PHARYNX

ONLY a few instruments are required for the examination of the mouth and pharynx.

They are : (1) A tongue depressor ; (2) a handled probe, bayonet shape, for palpation—the probe can be bent into a hook in examining the tonsil and supra-tonsillar fossa ; (3) an ordinary laryngeal mirror, for inspecting parts of the teeth and gums which cannot be seen by direct illumination, and also for examining the lingual tonsil.

Patient and surgeon should be seated facing each other, the latter occupying a somewhat higher seat.

The light having been focussed upon the patient's lips, he is directed to open his mouth, and to go on breathing quietly out and in just as usual. A tongue depressor should not be used at first, especially with children. The sight of it is enough to make many patients hold the breath in unpleasant anticipation, and it is sometimes possible to get a very good view without it. Let the patient intone ' Eh !' and notice how his palate and uvula contract while he does so. Then if necessary depress the tongue, applying the instrument in the middle line gently, but with a firm

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continuous pressure, which, if steadily kept up, will
subdue an unruly member much more effectually than
sudden force. The depressor must not be applied far
back, as pressure upon the base of the tongue is sure
to cause retching. The fauces having been inspected,
let the inside of the cheeks and the outside of the gums
be examined, the surfaces being held apart with the
tongue depressor placed in the angle of the mouth.
The inside of the cheek in the region of the last molar is
a favourite situation for syphilitic abrasions. Fraenkel's
or Lack's tongue depressor is a good useful pattern for
ordinary purposes ; for posterior rhinoscopy the one
known as Türck's is sometimes of distinct advantage.

In examining the mouth and throat in patients of
six years old and upwards, useful hints may often be
derived from observing the arrangement of the per-
manent teeth. The upper central incisors, instead of
being set straight or nearly so, in a line which forms
part of a wide curve, will frequently be found to be
set at an angle, meeting in front and slightly over-
lapping, or even forming a distinct **V**. This little
deformity is suggestive of a degree of nasal obstruction,
and will generally be found to be associated with the
presence of adenoid growths. In more pronounced
cases the central incisors are pushed forward and
become very prominent, the other teeth are unduly
crowded, the palate becomes narrow and deeply vaulted,
the chin recedes, and the typical physiognomy of the
adenoid facies is produced.

The causes which operate in producing these defor-
mities of the jaws may be stated as follows :

1. During mouth-breathing the chin is pulled down,
and the tension of the soft tissues of the cheeks is thus
considerably increased, and presses upon the upper

jaws; and this compressing force acting continuously
upon the soft growing bones exerts a powerful influence
in preventing their normal expansion.

2. The nostrils, not being used for breathing purposes,
miss the expanding influence of the respiratory air-
stream, which during normal breathing passes through
them some 20,000 times in twenty-four hours.

3. The receding chin is probably largely due to the
action of the depressor muscles of the lower jaw. These
muscles must hypertrophy very considerably before
they are able to overcome permanently the powerful
masticatory muscles which are opposed to them, and
which normally hold the mouth shut; and being con-
tinually in action in order to maintain the mouth open,
it seems probable that these hypertrophied depressors
may tend to pull back the lower border of the mandible
to which they are attached.

Decayed and suppurating teeth should be noted, for
they are frequent causes of reflex pain in the throat,
ear, head, and other parts of the body, and they some-
times also set up reflex spasm—*e.g.*, of the gullet or
glottis.

Pus from suppurating teeth is liable to infect any
fresh wound in the mouth or throat, such, for example,
as the cut surface of a tonsil; and the infection which
culminates in peritonsillar abscess sometimes owns the
same origin. In the latter case the lower wisdom tooth
is the one generally at fault. Suppuration in the
maxillary antrum is due in most cases to a carious
second bicuspid or molar tooth, and this may occur
when the offending tooth is to all appearance suffi-
ciently sound and useful, its deficiencies being covered
perhaps by a nicely-fitting gold crown. In such cases
as Dr. Woods of Dublin has pointed out, trans-

illumination affords a useful means of detecting a root-abscess.

Apart from definite local lesions, decayed and sup-purating teeth frequently do a vast amount of harm, partly by keeping up continuous nervous irritation, and partly by producing a kind of chronic toxæmia from the swallowing of septic pus. These evils are intensified by the practice—still far too common—of fitting an artificial denture on the top of a number of irritable stumps.

The floor of the mouth may be palpated with the finger ; it is there that the hot, brawny induration of Ludwig's angina is felt.   This is another most dangerous condition which may arise from suppurating teeth, the infecting organism being the *Streptococcus pyogenes.*

In inspecting the fauces note whether the arches are symmetrical, and whether the uvula hangs true in the middle line.   Test the mobility of the palate and uvula by directing the patient to say ' Eh !'   A soft palate which hangs far forward from the posterior pharyngeal wall, and is sluggish in its movements, is suggestive of some growth in the naso-pharynx such as adenoids or polypi, or large posterior hypertrophies of the turbinals. The post-nasal mirror will settle the question, and in such cases the examination is easy.   Failing such an explanation, paresis of the palate may be myopathic, and due to inflammatory infiltration, of which there will, of course, be evidence on inspection ; or there may be more complete paralysis of nervous origin, traceable, perhaps, to peripheral neuritis (after diphtheria pro-bably), or to central disease of the nuclei of the vagus or spinal accessory.

The moist congested states of the fauces included under the term ' relaxed ' throat are frequently due to

nocturnal mouth-breathing. The patient wakes in the morning with a dry tongue, and slight causes such as gargling, or cleaning the teeth, produce a tendency to retch. A more active engorgement of the fauces is sometimes described as ' gouty.' Certainly it occurs chiefly in those who eat and drink freely and take little exercise, and it is relieved by the general treatment appropriate to that condition.

The livid engorgement and œdema of a bad septic or erysipelatous throat is not likely to be mistaken for anything else, and the gravity of the general condition in such cases is very obvious.

The sore throat of secondary syphilis is a condition the prompt recognition of which is extremely important on account of its active contagiousness. The plaques appear first as little comma-like, grayish-yellow spots on the tonsils, especially about the edges of the crypts, and on the pillars of the fauces. A favourite site is close to the base of the uvula, and often the outline of the arch appears in consequence slightly notched at this point. As the spots coalesce they form larger whitish patches, which look very much as if nitrate of silver had been applied to the mucous membrane.

As the pharyngitis of syphilis causes considerable dysphagia, and is attended by a vivid red injection of the mucous membrane, it is not likely to be overlooked, although its nature may not be recognised; but the shallow symmetrical reniform ulcers of the tonsils which form one of the earliest and most constant signs of secondary syphilis are often quite painless, and not rarely escape detection.

Herpetic vesicles are sometimes seen on the soft palate, tonsils, and posterior wall of the pharynx, prob-ably as the result of microbic infection; but a true

herpes of the soft palate and uvula also occurs in some
chronic nervous diseases (tabes), and is strictly limited
to the region supplied by the fifth nerve.

Between the pillars of the fauces lie the tonsils,
hardly filling the recess, never actually projecting in
the normal condition. They are very frequently en-
larged as a result of chronic inflammation, and the
enlargement may be towards the mesial plane, so that
the tonsil projects inwards; or it may be from front to
back, so that the tonsil is greatly thickened, and yet
presents a flat surface, which projects only slightly or
not at all beyond the pillars ; or, lastly, the enlargement
may be chiefly downwards, an elongated lobe or process
dipping down into the pharynx. This last form of
enlargement is often combined with one of the other
two, especially the first or projecting tonsil, and in this
way is formed the bilobed tonsil, of which the lower lobe
is apt to be overlooked in operating.

The pillars of the fauces are sometimes tightly
stretched over an enlarged tonsil, and closely adherent
to its surface, and it may be necessary to free such
adhesions before performing tonsillotomy. Enlarged
glands are frequently found near the angle of the jaw
in cases of chronic tonsillitis, and recent researches
show that tubercle bacilli may pass through the tonsil
on their way to such glands without setting up tuber-
cular disease in the tonsil itself.   There is evidence, too,
that the tonsils act as centres of infection in various
so-called ' rheumatic ' diseases, including endocarditis,
and their morbid conditions have thus of late acquired
increased importance. Cases of acute tonsillitis with
membranous or pultaceous exudation are generally
due to mixed infection with various cocci, and it is
often impossible to tell without a bacteriological

examination whether diphtheria bacilli are present or
not.

Above the tonsil, between it and the pillars, is the
supratonsillar fossa, which extends for a variable
distance upwards and inwards into the soft palate.
It should always be examined with a bent probe or a
strabismus hook, as it is a favourite situation for con-
cretions.   Fragments resembling grains of oatmeal are
sometimes expelled with much hawking and discom-
fort, and when broken up these grains emit an extremely
fœtid odour.   Such little cheesy masses are very
common in the crypts of the tonsil.   They are most
frequently found at the apex of the gland, adjoining the
supratonsillar fossa, and in this situation they are often
associated with peritonsillar abscess.   Elsewhere, and
especially perhaps just behind the anterior pillar, they
give rise to recurring attacks of inflammation, some-
times associated with a certain amount of ulcerative
action from the breaking-down of partitions between
adjacent crypts.

Note with regard to the pillars of the fauces that the
anterior pillar, which contains the palato-glossus
muscle, is the weaker of the two, and lies more ex-
ternally ; the posterior pillar, which contains the
palato-pharyngeus, is much stronger, and extends
considerably further towards the middle line.   Thus
it is the antero-internal surface of the tonsil that is
exposed ; the postero-external surface is bedded against
the pillars and superior constrictor.

This relation of the pillars of the fauces must be
borne in mind in performing tonsillotomy.   The pos-
terior pillar must be pressed well outwards against the
lateral wall of the pharynx in order to get a satisfactory
section.   This means that the tonsillotome must cross

the buccal cavity obliquely from near the opposite
corner of the mouth.

The important structures nearest to the tonsil are
the ascending pharyngeal artery and the glosso-
pharyngeal nerve. The internal carotid artery is at
least ¾ inch behind and somewhat external to it. It is
hardly conceivable that a normal internal carotid
artery could be wounded in tonsillotomy by anything
short of the reckless use of a pointed bistoury.

Abscess in the substance of the tonsil is much less
frequent than peritonsillar abscess. In the latter the
pus nearly always points at the same spot—viz., ⅓ inch
from the edge of the anterior arch about its centre,
and this is the seat of election for incision. In a small
percentage of cases (only 2 per cent. according to
Moritz Schmidt) the abscess forms in the posterior
pillar, and must then be opened with greater caution
on account of the possible proximity of an abnormal
internal carotid. The commonest cause of periton-
sillar abscess is the presence of caseous concretions in
the crypts of the upper part of the tonsil or in the
supratonsillar fossa. Another cause, often unsuspected,
is a suppurating lower wisdom tooth.

The term ‘ulcerated sore throat’ is often loosely
applied to cases of lacunar tonsillitis in which the dis-
tended crypts show as yellowish-white spots, or in
which they have ruptured, causing a superficial breach
of surface. Cases of ‘septic sore throat,’ too, ‘hospital
throat,’ and cases of mixed infection with masses of
pultaceous exudation on the tonsils, are sometimes so
described ; but the term is a popular one, and is better
discarded, or reserved for cases in which ulceration is
the essential feature.

The commonest causes of ulceration in the throat

are syphilis and cancer. The former is most fre-
quent in young adults, the latter in elderly persons.
Secondary syphilitic ulcers have sharply-cut edges,
and are attended by much reaction. Tertiary ulcers
(breaking-down gummata) show a grayish-white sloughy
base, and cause the most rapid destruction of parts.
In cancerous ulcers *induration* is a prominent feature,
and *the part feels fixed*. In cases where there is doubt
the test of antisyphilitic treatment should be applied.

A shallow painless reniform ulcer on the tonsil or
just above it is characteristic of secondary syphilis,
and is a very early manifestation. An indolent ulcer
occasionally forms on the tonsil in weakly anæmic
persons. It causes no reaction, is not associated with
either syphilis or tubercle, and heals as the health
improves.

Tubercular ulcers, due here as elsewhere to the
breaking-down of solid deposits, are rare in the fauces,
and occur chiefly in the later stages of phthisis, when
they give rise to much distress.

Lupus ulceration occurs in the fauces, sometimes
without any similar disease of the skin to guide one to
a diagnosis. It follows an extremely slow dragging
course, and gives rise to marvellously little pain or
discomfort, considering how extensive the ulceration
sometimes is. The ulcerated surface is very irregular
and uneven, and presents a peculiar worm-eaten ap-
pearance which is very characteristic. Cicatricial
adhesions may form at one part of the field—as between
the palate and posterior wall of the pharynx—while
ulceration is slowly extending in other parts, and the
patient's general health is often fairly good. By some
authorities the process is regarded as a chronic tuber-
culosis of the mucous membrane.

The terrible sloughing throats which were occa-
sionally seen in cases of scarlatina and diphtheria
twenty-five or thirty years ago are now practically un-
known, thanks to improved hygienic conditions and
to the gospel of cleanliness, which has changed so many
things in medicine and surgery in the course of the last
generation.

Waldeyer's Lymphatic Ring.

The principal masses of lymphoid tissue in the throat
are arranged in a circular manner round the entrance
of the respiratory and digestive tracts, and this cir-
cular arrangement is called **Waldeyer's ring**.   It con-
sists of the two faucial tonsils, two lingual tonsils, one
pharyngeal tonsil, and two tubal tonsils.

1. The faucial tonsils have already been considered.

2. **The Lingual Tonsil** lies on the base of the tongue,
just in front of the epiglottis, or, more accurately, in
front of the glosso-epiglottic fossa, and just behind the
foramen cæcum and the circumvallate papillæ.   In
children there is a widespread layer of lymphoid
follicles covering this part of the base of the tongue,
and practically reaching from one faucial tonsil to the
other.   In adults most of the follicles have disappeared,
but a few of the external ones are left on each side, and
these, when hypertrophied, form two more or less
hemispherical masses which, when enlarged, may press
against the epiglottis, or even surmount the edge of
that structure, so that secretion trickles down its
laryngeal surface, causing troublesome cough.   En-
largement of the lingual tonsils seems to be most fre-
quent in women, and gives rise to much discomfort
and many abnormal sensations about the throat,

especially in neurotic subjects. In order to examine
this region properly the tongue must be held out with
a cloth, and the laryngoscope used.
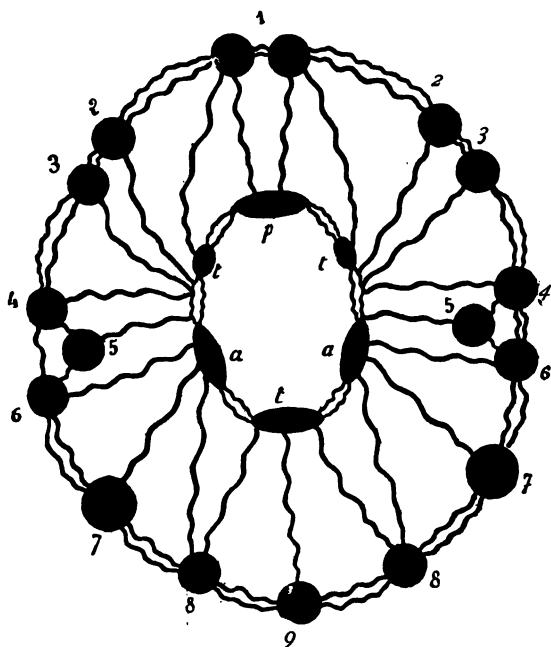
FIG. 1.—DIAGRAM OF WALDEYER'S LYMPHATIC RING AND ITS
CONNECTIONS WITH THE LYMPHATIC GLANDULAR SYSTEM.
(AFTER ESCAT.)

1. Retro-pharyngeal.   2. Styloid.   3. Lateral pharyngeal.   4. Behind sterno-
mastoid.   5. Bifurcation.   6. In front of sterno-mastoid.   7. Angle of jaw.
8. Hyoid.   9. Subhyoid : *p*, Pharyngeal ; *t*, Tubal ; *a*, Faucial ; *l*, Lingual
Tonsils.

The inner ring represents the ring of tonsils—viz., lingual,
faucial, tubal, and pharyngeal—and the outer ring represents
the adjacent lymphatic glands with which they are connected.
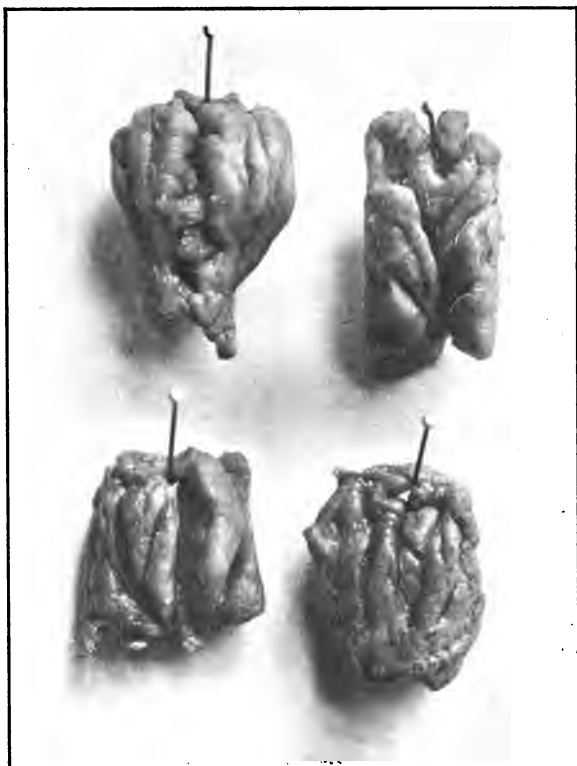
FIG. 2.—ADENOID GROWTHS (NATURAL SIZE, BUT SHRUNKEN
SOMEWHAT FROM PRESERVATION IN FORMALIN).

The hypertrophy is fairly uniform in the two upper specimens,
while in the two lower it is more irregular. The largest specimen
was removed from a child of three years.

3. **The Pharyngeal Tonsil**, enlargement of which
constitutes 'adenoid growths' (Fig. 2), occupies the

vault and upper part of the posterior wall of the naso-
pharynx.   In its typical form the mass forms a quadri-
lateral layer 4 to 6 millimetres in thickness, and the
tissue is arranged in a number of pleats or folds, which
run longitudinally, but converging somewhat towards a
common centre on the posterior wall of the pharynx
just above the atlas tubercle.   This tonsil is completely
formed at three months of age, and normally begins to
atrophy about the age of eleven or twelve.   Between
the pleats or folds of tissue are furrows or recesses.   The
central recess is the best marked, and when closed by
adhesions and filled with fluid it is sometimes called
the pharyngeal bursa.   Suppuration in this ' bursa '
was described by Tornwaldt, and the affection has been
dignified with the name of Tornwaldt's disease.   The
pharyngeal tonsil is often hypertrophied irregularly, so
that parts of the folds form pendulous pedunculated
masses, but when removed in one piece by a suitable
curette the original plan of the tonsil can generally be
recognised.

4. **The Tubal Tonsil** (Fig. 3) is a little collection
of adenoid tissue situated on the posterior lip of the
trumpet-shaped opening of the Eustachian tube, and
extending backwards towards the fossa of Rosenmüller.
When hypertrophied, as in some cases of adenoids, it
forms a layer of growth which extends back into Rosen-
müller's fossa, and covers a considerable part of the
lateral wall of the naso-pharynx, and there may also
be little pedunculated masses attached to the Eus-
tachian cartilage.   In adults adhesions and cicatricial
bands are sometimes seen in Rosenmüller's fossa as a
result of the atrophy of old adenoids.

Fig. 1 shows in a diagrammatic form the arrangement
of Waldeyer's ring, and its connections with the neigh-

bouring lymphatic glands. The whole arrangement is considered to represent an inner and an outer defensive circle exercising protective functions, and preventing by phagocytosis the entrance of morbific micro-organisms. However this may be, it is certain that the structures composing Waldeyer's ring very frequently

Median recess

Pharyngeal tonsil

Rosenmüller's fossa

Tubal tonsil

Tube

Opening of Eustachian Tube.

Middle turbinal

Lower turbinal

Uvula
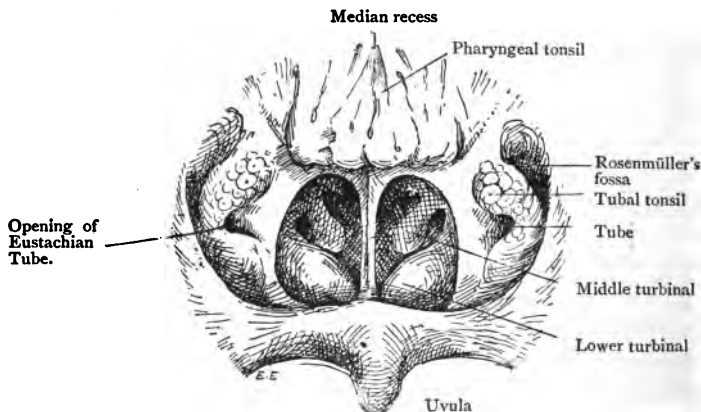
FIG. 3.—POSTERIOR RHINOSCOPIC VIEW IN A CHILD OF FIVE. (AFTER ESCAT.)

The head or upper end of the pharyngeal tonsil is well shown lying close to the upper part of the septum, and the converging folds of tissue which lie on each side of the median recess are indicated.

fail to protect the organism from invasion, and become themselves sources of trouble and centres of infection.

In addition to the masses of adenoid tissue which constitute Waldeyer's ring, there are numerous lymphoid follicles on the posterior and lateral walls of the pharynx, and these also are very liable to hypertrophy. Little flattened red granules scattered over the posterior wall are very common, or the granules may become confluent

into raised patches of soft gelatinous-looking tissue; or, again, the lymphoid granules may be seen chiefly on the salpingo-pharyngeal fold, which lies just behind the posterior pillar of the fauces, and looks, when much hypertrophied, exactly like a third or extra pillar. If this condition of lymphoid hypertrophy is at all marked in the pharynx, where it is easily seen, it is very likely (in the case of young subjects) that it will also obtain in the naso-pharynx, where it is less easily seen, but can be readily felt as adenoid growths.

Hypertrophy affecting the other elements of the mucous membrane is not rare in chronic pharyn-gitis. The condition may be general, all the parts being thickened and fleshy, so that the isthmus of the fauces is greatly reduced in size; or the hyper-plasia may be limited to certain parts, such as the pos-terior pillars, or the salpingo-pharyngeal folds on the lateral walls of the pharynx. In the latter situation chronic hypertrophy is not uncommon as a cause of vocal impairment, and is spoken of as *Pharyngitis lateralis.*

Atrophic changes in the pharynx are practically always secondary to very chronic suppuration in the nose, and are most evident on the posterior wall, down which, of course, the pus flows, and on which it forms crusts or films. Dryness of the posterior wall of the pharynx is seen in cases of ' ozæna,' and chronic nasal suppuration (especially of the posterior group of acces-sory cavities), in which the turbinated bodies have atrophied, so that the inspired air passing through the wide nasal passages is no longer able to saturate itself with watery vapour, as it does normally during its sojourn in the nose, and so it absorbs moisture from the posterior wall of the pharynx, leaving the

2—2

mucous membrane dry, often dusky red, and covered
with a thin film of dried secretion.

Simple collapse of the erectile tissues of the nose, as
it is seen in some delicate anæmic women, also pro-
duces a kind of *Pharyngitis sicca*, but the absence of
crusting and suppuration will at once distinguish the
two classes of cases.

A dry inflamed throat is seen in cases of diabetes, and
may be a most troublesome symptom, but with ordinary
care it is not likely to be mistaken for the main disease.

A smooth bulging of the posterior wall of the pharynx
indicates the presence of a retro-pharyngeal abscess,
but the swelling is not always so obvious as might be
supposed. The chief complaint may be of dysphagia,
and the writer has known a patient to be fed through
a tube for some days before the presence of an abscess
was detected.

A slight amount of swelling, generally most marked
at one side, usually indicates enlargement of one or
both of the retro-pharyngeal lymphatic glands, which
may probably subside without suppuration.

Secretion, mostly pus or muco-pus, is often seen on
the posterior wall of the pharynx, passing down from
behind the palate. In children far the most probable
source of such secretion is adenoid growths, and it is a
good plan in finishing the inspection of the pharynx in
such cases to depress the tongue sufficiently to induce
retching, when the contraction of the palate and fauces
tends to squeeze out any secretion that may be present
and bring it into view. A good view of the epiglottis
is often obtained at the same moment in children. In
adults with the shrunken remains of old adenoids the
secretion is less copious, and generally forms a crust
(the ' oyster-shell ' crust), which adheres to the upper

part of the posterior wall, giving rise to much discom-
fort. The patient feels that there is something there
all the time, and the crust is dislodged at intervals of
one or two days after much retching and hawking. In
nervous women headache and neurasthenic symptoms
are not uncommon in such cases, probably as a result
of the long-continued irritation of a highly sensitive
area. The attacks of ' croup ' from which children
with adenoids suffer are caused by secretion dropping
down on to the glottis during sleep; and chronic hoarse-
ness in children is most frequently due to the same
cause. It is necessary to see the larynx, however, in
order to make sure that the hoarseness is not due to
the presence of papillomata, which are not uncommon
in children.

In adults suffering from nasal suppuration thick
yellow pus is often seen coating the posterior wall of
the pharynx, especially when the posterior sinuses are
diseased. Pus from the anterior sinuses may, of course,
find its way into the throat readily enough, especially
in certain positions of the head; but nevertheless it
is true as a general rule that if a patient complain
chiefly of pus dropping into the throat, *and of throat
and chest symptoms*, the posterior sinuses are the most
probable source of the trouble, whilst if the complaint
be of soiling many handkerchiefs with pus, and of
a bad smell in the nose, the anterior sinuses are
indicated.

The adenoid region must be carefully examined in
every case of suspected disease of the posterior sinuses,
as suppurating remains of adenoids give rise to a very
similar train of symptoms.

Having inspected the fauces and pharynx, the next step
in a systematic examination is **posterior rhinoscopy.**

This is at times a somewhat difficult manipulation, and so is best undertaken while the patient is fresh and before his throat has become irritable. It is usually possible to tell at a glance in any particular case whether this form of examination will be easy or difficult. In a few cases it is impracticable by ordinary methods— *i.e.*, without the use of cocain and a palate hook. If on inspecting the pharynx it is seen that the soft palate hangs relaxed and immobile, with a fair amount of space between it and the posterior wall, and if the tongue can be well depressed without exciting contraction of the palate and pillars, then posterior rhinoscopy may be expected to be easy and satisfactory. If, on the contrary, the fauces are congested and irritable, the soft palate almost touching the posterior wall, and the palate and pillars twitching on the slightest provocation, it is sure to be difficult, and may be impracticable. Alcoholism, much smoking, and mouth-breathing all tend to produce this latter condition.

The patient should be seated directly opposite the surgeon, on a somewhat lower chair, and directed to open his mouth and continue breathing quietly, if possible through the nose. The examiner focusses his light on the posterior wall of the pharynx, and depresses the tongue till there is sufficient space to pass the small post-nasal mirror between the uvula and the right faucial arch without touching either of these structures or the base of the tongue. It is a help to the surgeon to steady the tongue depressor by resting his left hand against the patient's chin, and this also enables him to alter the inclination of the patient's head according to the exigencies of the examination. The tongue should be pulled forward against the lower jaw rather than pressed backward. If the mirror can be placed behind

the soft palate and uvula without provoking contrac-
tion, the rest is easy. Held lightly, pen-fashion, it is
moved to a more central position with its reflecting
surface directed upwards and forwards. The first land-
mark to look out for, and often the first to spring into
view, is the posterior edge of the vomer (Fig. 3A). It is
pale pink in colour, sharp, smooth, and clean in outline.
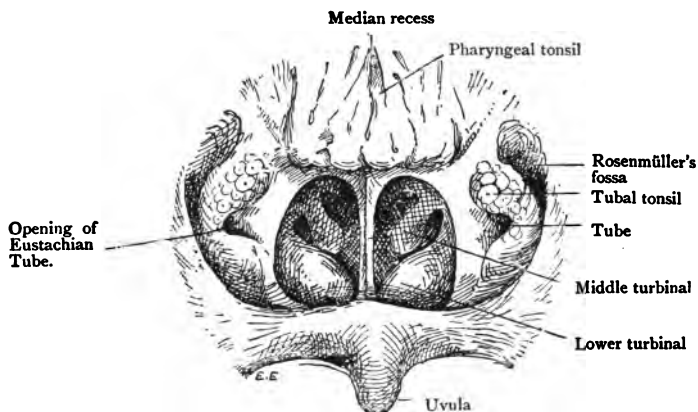
FIG. 3A.—POSTERIOR RHINOSCOPIC VIEW IN A CHILD OF
FIVE. (AFTER ESCAT.)

The head or upper end of the pharyngeal tonsil is well shown
lying close to the upper part of the septum, and the converging
folds of tissue which lie on each side of the median recess are
indicated.

It broadens out above on to the pharyngeal vault (where
the pharyngeal tonsil or its remains may be seen), and
it is cut across below by the line of the soft palate. On
each side of the vomer are seen the posterior nares with
the three turbinated bodies. The middle turbinal is
the most completely seen, and may be followed along
the nostril for some distance. The lower turbinal is

partly concealed below by the soft palate, and the superior turbinal is somewhat dimly seen in the distance. The turbinals are normally of a pale pinkishgray colour, the pharyngeal vault and soft palate are of a rose-pink hue. By inclining the mirror towards the horizontal the vault and posterior wall are brought into view ; by inclining it towards the vertical the soft palate and the lower turbinals are caused to enter the field.

On each side of the posterior naris, and apparently on a level with the end of the middle turbinal, is the opening of the Eustachian tube. It is brought into view by inclining the mirror slightly to one or other side, and is easily recognised by its pale yellow colour and by the overhanging margin of cartilage (the Eustachian cushion), which bounds it posteriorly, and appears in consequence above it in the mirror. Behind the Eustachian cushion—*i.e.*, above it in the mirror— is the fossa of Rosenmüller, and extending downwards from the tubal opening are the salpingo-palatine and salpingo-pharyngeal folds. These latter are not as a rule well seen, but the best view of them is got by holding the mirror low down against the lateral wall of the pharynx, behind the posterior pillar, with the reflecting surface inclined towards the opposite side.

Sometimes the mere introduction of a mirror into the mouth, without any contact with the mucous membrane, is sufficient to cause contraction of the soft palate, so that it is drawn up and lies close to or touching the posterior wall. In such cases it is a good plan to direct the patient to ‘ sniff up.’

In posterior rhinoscopy, owing to the fact that the mirror is placed obliquely and considerably below the level of the structures reflected in it, the relations of the

various parts of the image do not quite correspond with anatomical facts, and allowance must be made for a considerable amount of foreshortening, both in the vertical and the horizontal directions. This applies to the anterior, lateral, and posterior walls of the space.

When a satisfactory view cannot be obtained, it is a good plan to let the patient practise with a tongue depressor in front of a mirror for a few minutes twice a day. In a week or ten days an excellent view can generally be obtained. Türck's tongue depressor is the best for this sort of practice.

Occasionally the tongue depressor is worse than useless, but a view may yet be got by using a larger-sized mirror, and depressing the tongue with the back of it just sufficiently to allow it to pass the palate and uvula into position.

Spraying the fauces with a few drops of 5 per cent. cocain solution facilitates examination by dulling the sensibility of the mucous membrane, but it rather tends to increase the reflex contractility of the muscles.

In cases where posterior rhinoscopy is not practicable palpation must be substituted for inspection. The child is seated on a chair, and the surgeon, standing at its right side, steadies the head against his side and presses the cheek in between the teeth as the mouth is opened. The examiner's right index-finger is then passed back to the posterior wall of the pharynx (provoking retching), and quickly slipped up behind the right posterior pillar. The finger is passed up to the vault, and the sharp posterior edge of the septum is easily felt.

On each side of it are the posterior ends of the middle and lower turbinals, and more posteriorly the Eustachian cushions. As the finger is withdrawn the upper part

of the posterior wall may be swept from side to side.
When the object of the examination is merely to find
out whether a child has adenoids it may be done very
rapidly, but when a detailed examination is required
it is best to wait till the muscular contraction caused
by the introduction of the finger has passed off, and
then palpate the parts deliberately in succession.   In
children this is best done during ethyl chloride
anæsthesia, which gives abundance of time, and causes
no after-depression.   It is well to use a finger-guard
while making this examination ; the best and cheapest
is a piece of rubber tubing of a size to fit the index-
finger.

The **morbid conditions** which the student is likely
to meet with in examining the naso-pharynx are not
numerous, and if a view can be obtained their recognition
is generally easy.

An inflamed state of the mucous membrane is frequent
enough, and under favourable conditions (*i.e.*, a normal
nose) passes quickly away ; the mere fact of its per-
sistence should suggest some other factor—*e.g.*, anterior
nasal obstruction, remains of adenoids, posterior sinus
suppuration, etc.

Intercurrent attacks of acute inflammation of the
pharyngeal tonsil are very common in children with
adenoids, and intensify all the symptoms.   If it should
chance that the faucial tonsils are also enlarged and
simultaneously inflamed, a very distressing—or even
alarming—condition may arise, calling for operative
interference even at the height of the attack.

Suppurative inflammation in or near the pharyngeal
tonsil (retro-nasal phlegmon) also occurs, and gives
rise to severe general symptoms, sometimes rather
suggestive of nasal diphtheria. but the condition is

relieved after a few days' illness by a discharge of pus
from the nose.

The recognition of adenoid growths in the mirror is
not generally very difficult. In slight cases the upper
part of the septum is hidden by a cushion of soft tissue,
which conceals perhaps one-third or one-quarter of the
sharp posterior edge of the vomer ; in bad cases the
septum may be almost entirely hidden and the posterior
nares occluded. What looks in the mirror to be quite
a small mass will be found on removal to be much
larger than it appeared.

Suppurating remains of adenoids in adults generally
occupy the upper part of the posterior wall, and in
bad cases a large 'oyster-shell' crust of dried pus forms
on the surface, and may be seen in the mirror.

Enlargement of the posterior ends of the lower
turbinals is common, and usually appears as a pale
gray swelling, smooth and globular when it is due to
œdema, or covered with little projections when it is a
chronic hypertrophy. When purplish in colour from
enlarged veins the swelling is aptly called a 'mul-
berry' hypertrophy. The posterior end of the middle
turbinal is subject to the same kind of enlargement,
but it is less frequently affected. Ordinary nasal
polypi may often be seen from the back, and in cases
where the septum is deflected the posterior view conveys
useful information regarding the narrow nostril. Two
other forms of new growth must be kept in mind in
connection with the naso-pharynx, viz. : (1) The choanal
polypus, a softish bluish growth, generally solitary,
growing by a long slender pedicle from the edge of the
posterior nares, and very freely movable. It is really
a soft fibroma. (2) The fibrous tumour of the naso-
pharynx, a firm fixed growth springing by a broad

attachment from the base of the skull. It is red in colour, highly vascular, and frequently causes epistaxis ; it grows only during the period of adolescence, and shrinks in adult life if the patient survive long enough— pathologically a fibro-sarcoma.

Gummatous ulceration is not uncommon in the naso-pharynx ; on the posterior or lateral wall it is easily seen, but on the posterior surface of the soft palate it is readily overlooked, and a perforation of the velum may be the first intimation it gives of its presence.

Pus is often seen in the naso-pharynx and posterior nares. When formed in the naso-pharynx its commonest source is the pharyngeal tonsil—adenoid growths or the remains of them—and the diagnosis is easily made, but in many cases there are no traces of adenoids. Frequently pus can be traced into the posterior nares towards its probable source in the posterior ethmoidal cells or the sphenoidal sinus. In these cases the upper surface of the middle turbinated body may often be seen coated with pus, whilst a long string of ropy secretion trails down on to the soft palate ; or the upper part of the septum and the adjacent part of the body of the sphenoid may show redness and swelling, evidences of chronic irritation due to the continual trickling down of septic pus, although no pus may chance to be visible at the time of examination.

Pus from the ear sometimes drains into the naso-pharynx through the Eustachian tube, and may be seen lying in the trumpet-shaped opening, or flowing down from it. It is very probable that the pneumonia which is occasionally associated with otitis media is directly due to the inspiration of the same virulent micro-organisms which have caused the otitis.

THE EXAMINATION OF THE NOSE

FOR examining the anterior nares, specula, a probe
(the same one will do for the pharynx and ear), a long
pair of angled nasal forceps, and cotton carriers are
necessary, and last, but not least, a fine cocain spray
with a single bellows, throwing not more than about
one drop for each compression of the ball.

The writer nearly always uses Thudichum's specula
(two sizes are required), and occasionally a Duplay's
speculum for children. Lennox Browne's is another
admirable speculum, especially when the skin is cracked
at the entrance of the nostril.

A small post-nasal mirror is used to get a view of the
anterior recess of the vestibule—the inside of the tip of
the nose.

Anatomical Points.

The vestibule or porch of entrance to the nose (Fig. 4)
is the little ampullated chamber which lies between the
ala nasi and the septum, in front of the opening of the
naris proper. Its outer wall is lined by skin, its inner
wall is partly covered by mucous membrane, and stout
hairs project into the cavity, forming a sort of protective
screen. On the outer wall of the vestibule is a fold of

mucous membrane called the plica vestibuli, which
marks the entrance to the nasal cavity proper.   This
entrance is somewhat narrowed from side to side.

A horizontal section of the nasal cavity shows it to
be somewhat boat-shaped.   In front it narrows like the
prow of a boat to the anterior nares; behind it also
narrows, but to a less extent, like the stern of a boat
as compared with the bows.   The floor of the nose is
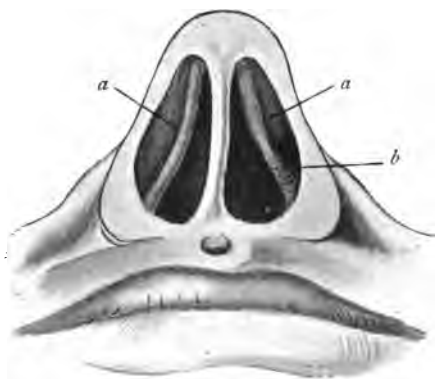
FIG. 4.—THE VESTIBULE AS SEEN FROM BELOW, SHOWING THE
PLICA VESTIBULI.   (AFTER ZUCKERKANDL.)

a, a, Plica vestibuli.   *b*, Entrance of nose.

mainly horizontal, but it also shows a distinct con-
cavity, both from front to back and from side to side.
Its highest part is in front at the anterior nasal spine.
The roof of the nose is almost horizontal in its median
part, which is composed of the cribriform plate of the
ethmoid.   In front the roof slopes downwards to the
anterior nares, and this anterior slope is made up chiefly
of the nasal bones, the nasal processes of the superior
maxillæ, and the nasal cartilages.   Behind there is a

shorter and steeper slope corresponding with the body
of the sphenoid. The posterior slope does not come
down so low as the anterior ; it descends only to the
level of the posterior nares, which have thus a con-
siderably greater vertical diameter than the anterior.
Each posterior naris measures in an adult man about
1 inch from above downwards, and ½ inch across. In
women the vertical diameter is about ⅞ inch, and the
transverse ½ inch as in man. In a new-born infant the
posterior naris is round, and measures barely ¼ inch
across. Such a small opening is very easily obstructed.
The anterior nares are also more rounded in shape in
children than in adults.

The nasal cavity is much narrower above than below,
being encroached upon by the ethmoidal cells and the
frontal sinus (Fig. 5). The cribriform plate measures
only 2–3 millimetres across, while the floor of each
nostril at its widest part is about 15 or 16 millimetres
from outer wall to septum.

The nasal cavity may thus be naturally divided into
a wide lower portion, which lies below the inferior
border of the middle turbinal, and a narrower upper
portion, which lies above the level of that border. The
lower division is the respiratory, and the upper the
olfactory region of the nose.

Curving downwards and inwards from the outer
wall of the nasal cavity are the three turbinated or
spongy bones, each of which overhangs a corresponding
passage or meatus (Figs. 6 and 11). Each meatus is
bounded externally by the outer wall of the nose, and
opens internally into the narrow space adjoining the
septum sometimes called the common meatus of the
nose. A spongy bone with its investing soft parts is
called a turbinated body or turbinal. Practically the
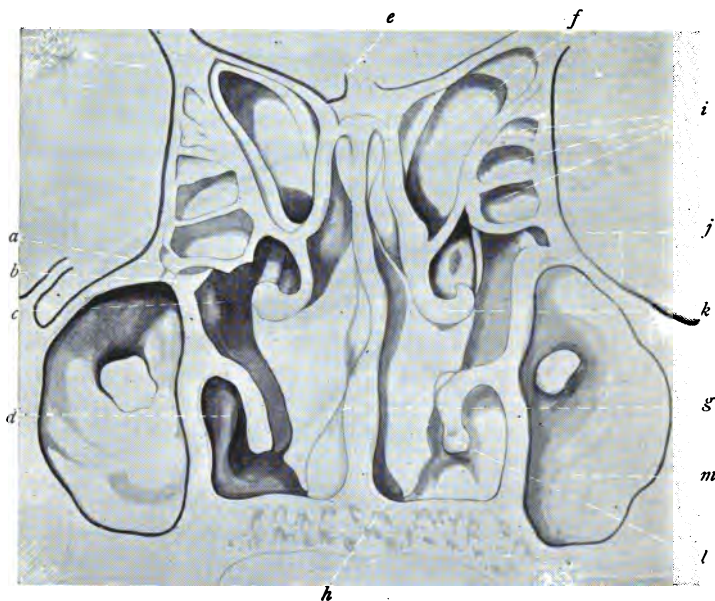
FIG. 5.—TRANSVERSE VERTICAL SECTION THROUGH THE NASAL
CAVITIES AT THE LEVEL OF THE SECOND BICUSPID TOOTH,
DIVIDING THE OSTIUM MAXILLARE. IT SHOWS THE GENERAL
ARRANGEMENT OF PARTS IN A TYPICAL CASE. (AFTER
FRAENKEL.)

a, Antral opening.   *b*, Unciform process.   *c*, Middle meatus.   *d*, Lower meatus.
e, Crista galli.   *f*, Frontal sinus.   *g*, Septum.   *h*, Hard palate.   *i*, Ethmoidal
cells.   *j*, Orbit.   *k*, Middle turbinal.   *l*, Lower turbinal.   *m*, Antrum.

The section extends from the crista galli above to the hard
palate below.   In the middle line is the septum, presenting a
slight deviation.   On each side of the septum at the upper
part is the olfactory fissure, which is bounded externally by
the frontal sinus above and the middle turbinal below.   The
frontal sinus is large, and extends as far down as the attach-
ment of the middle turbinal.   Externally to the frontal sinus,
lying between it and the orbit, are the ethmoidal cells, which
are seen to form the roof of the middle meatus.   The maxillary
antrum is well developed, and extends as usual below the level
of the floor of the nose.   This section is too far forward to show
the superior turbinal.

need only concern himself with the lower and middle
turbinals, of which the latter belongs to the ethmoid.

The erectile tissue of the nasal mucosa is mostly found
on the lower turbinal, which is practically covered by
it ; but this tissue also occurs to some extent on the
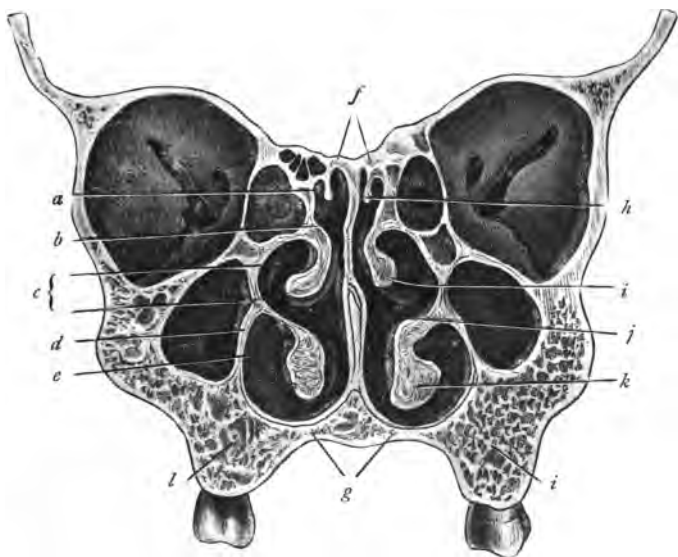
FIG. 6.—TRANSVERSE SECTION OF NASAL FOSSÆ RATHER
BEHIND THEIR CENTRE. (AFTER ZUCKERKANDL.)

a, Superior meatus.   *b*, Olfactory fissure.   *c*, Middle meatus.   *d*, Inner wall
of antrum.   *e*, Inferior meatus.   *f*, Cribriform plate.   *g*, Hard palate.
h, Superior turbinal.   *i*, Middle turbinal.   *j*, Respiratory fissure.   *k*, Inferior
turbinal.   *l*, Alveolar process.

middle turbinal, chiefly on the lower border and in the
posterior extremity.

The chief artery of the nose is the spheno-palatine
branch of the internal maxillary (Fig. 7). Entering
the nasal cavity at the upper and back part of the outer

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wall, close to the posterior end of the middle turbinal, it divides at once into two branches. Of these one—the naso-palatine artery—supplies the upper part of the olfactory tract and the septum. Starting from the body of the sphenoid, its branches run forward and downward, anastomosing above with the ethmoidal arteries, and below and in front with the anterior artery of the septum close to the entrance of the nose.

The other branch—the posterior nasal artery—splits up into vessels which run forward in more or less parallel lines along the outer wall of the nose, supplying the middle and inferior turbinals and the corresponding meatūs. The arrangement is pretty constant. A large artery runs along the lower border of the middle turbinal, a smallish one descends to the inferior meatus, and the main trunk of the vessel passes to the posterior end of the lower turbinated body, which is richly supplied by the three terminal branches—a large one coursing along the centre of its convexity, a smaller one following its lower border, and a third supplying its upper part and the adjoining regions of the middle meatus. The arteries lie close to the bone, and at parts are contained in grooves which furrow the spongy bones. There is free anastomosis between all the branches, and also with the ethmoidal arteries which run down from the roof of the nose. Thus all the larger arterial trunks of the nasal cavity lie at its posterior and upper part.

The veins of the nose communicate *above* through the ethmoidal veins with those of the olfactory plexus and frontal lobe ; *anteriorly* with the veins of the face ; and *posteriorly* with those of the palate, pharynx, and spheno-maxillary fossa.
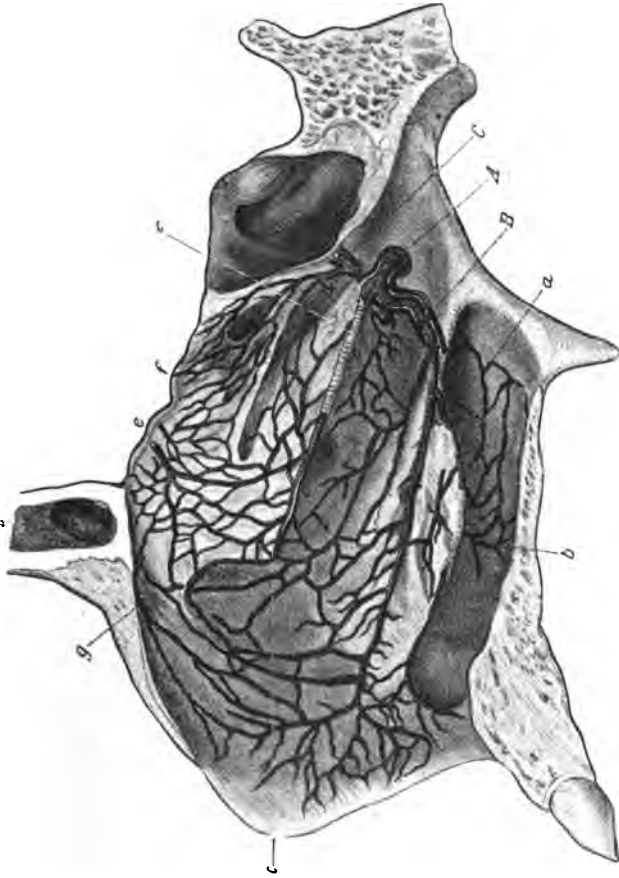
Fig. 7.—The Lateral Wall of the Right Nasal Cavity, showing the Arteries. (After Zuckerkandl.)

A, Posterior nasal artery; *c c*, branch to the middle turbinal; *a* and *b*, branches to the lower meatus. *B*, Main trunk dividing at the posterior end of the lower turbinal into three branches, for the supply of that body and the adjoining parts of the middle meatus. *C*, Naso-palatine artery, giving off branches to the superior turbinals. *e* and *g*, Branches of the anterior ethmoidal artery. *f*, Anastomosis with posterior ethmoidal artery. The vense comites of the posterior nasal artery are shown passing through the spheno-palatine foramen with that vessel.

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Examination.

The greater part of the vestibule may be inspected
by simply raising the tip of the nose, but in order to
get a good view of its anterior recess (which lies just
behind the tip of the nose) it is convenient to use a
small mirror such as the post-nasal one. In order to
see beyond the vestibule the blades of a speculum
should be introduced well within the ala (but not as
far as the plica vestibuli), and care must be taken that
the edge of the septal blade does not press on the
mucous membrane, which at this point often covers
a more or less prominent ridge on the cartilage.

The introduction of a nasal speculum should be quite
painless if properly managed. When the skin is
cracked it is well to apply a pledget of absorbent wool
soaked in cocain (10 per cent.), and wait two or three
minutes. The spring of a Thudichum's speculum is
often too strong ; the wire of which it is made should
be resilient, but quite a weak pull is all that is necessary
to hold the nostril open. The dragging sensation caused
by a strong spring is extremely unpleasant to the
patient, and although the spring can be compressed
instantly by the examiner, and held so, yet in prolonged
manipulations this is inconvenient, and indeed may be
rather hard on the examiner's finger. Thudichum's
speculum is best held as represented in Fig. 8. It
is manipulated entirely with the left hand. Lennox
Browne's is held much in the same way as Thudi-
chum's, and is an extremely comfortable speculum.
Fraenkel's is also managed with the left hand, the screw
which opens the blades being rotated between the
thumb and middle finger. Duplay's requires the use
of both hands, and is suitable for examining children.

If the patient's head be only slightly tilted backwards the parts that come into view through the speculum when the light is focussed on the naris are the anterior end or ' head ' of the lower turbinal and the corresponding part of the septum, covered by mucous membrane of a deep red colour. The head of the turbinal will be

FIG. 8.—METHOD OF HOLDING THUDICHUM'S SPECULUM.

The instrument is represented partially compressed ; as it is introduced within the ala the blades are closely pressed together.

found to vary much in size in different persons and also in the same person at different times. When the cavernous tissue which covers it is in a state of erection, the head of the turbinal lies partly in contact with the septum, and blocks the nostril more or less completely.*

* To facilitate examination in cases in which the cavernous tissue is more or less engorged it is well, after a preliminary inspection, to use a spray of cocain (5 per cent.) and adrenalin chloride (1 in 10,000). The spray should be a very fine one, throwing not more than one drop for each squeeze of the bellows,

When the cavernous tissue is contracted—as from ner-
vousness or the application of cocain—there is a space
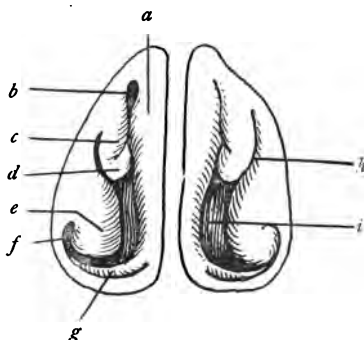
Fig. 9.—Anterior Rhinoscopic View in a Case in which
the Nostrils are Fairly Roomy or have been Moder-
ately Dilated with Cocain. (Semi-diagrammatic, after
Gerber.)

a, Septum.   *b*, Olfactory fissure.   *c*, Anterior end of middle turbinal.   *d*, Pos-
terior part of middle turbinal.   *e*, Lower turbinal.   *f*, Inferior meatus.
g, Floor of nose.   *h*, Middle meatus.   *i*, Posterior wall of pharynx.

of several millimetres between the turbinal and the
septum, and the observer can see for a considerable

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and the bellows must be a single one, so that the spray can be
managed by the right hand while the speculum is held in the
left.   This is quicker and pleasanter to the patient than painting
the mucous membrane with a brush of absorbent wool soaked
in cocain.   The cocain and adrenalin solution enlarges the
window through which one looks into the nose by shrinking
up the head of the lower turbinal ; it enlarges the nasal cavity
itself by contracting the vessels of the mucous membrane, and
it throws parts into relief by bleaching them to some extent so
that they are better able to reflect the light.

Used as directed above there need be no fear of toxic symptoms,
especially as cocain and adrenalin are to a great extent antago-
nistic in their general action.   The patient should breathe
through the mouth while the spray is being used.

distance into the nostril. Indeed, in most cases a
skilled observer can see right through the nostril, and
distinguish the glistening reflection which marks the
posterior wall of the naso-pharynx. This is true of all
cases in which a straight line can be drawn through the
inferior meatus to the posterior wall of the naso-pharynx
without touching the walls of the nose, but very often
the passage through the nasal cavity of one side is
sinuous, so that it is impossible to see right through
it. The glistening reflection on the posterior wall of
the naso-pharynx is a very characteristic appearance,
and when once recognised is not likely to be mistaken
for anything else.

A normal lower turbinal presents as a rule a smooth
convex inner and upper surface, and a somewhat undu-
lating or sinuous outline as seen from before backwards.
The inferior meatus, which is partly open to inspection
in this position, is that part of the nasal cavity which
lies under cover of the lower turbinal, and is overhung
by it. Internally the inferior meatus opens into the
common meatus of the nose—*i.e.*, the narrow space
next the septum, which is not overhung by any tur-
binated body, and into which all the meatūs open
(Fig. 6).

The septum is rarely straight, but generally presents
an undulating surface. Deflections are very common,
and are hardly considered abnormal unless they inter-
fere with nasal respiration.

Ridges on the cartilage are very frequent in front.
They are placed close to the floor of the nose, and may
be horizontal, or slope upwards and backwards along
the line where vomer and cartilage join, sometimes
extending as far as the body of the sphenoid.

If now the head be tilted somewhat farther back-

wards the upper part of the lower turbinal and the
lower part of the middle turbinal come into view.   As
a matter of convenience, this is the position in which

FIG. 10.—THE ANTERIOR RHINOSCOPIC VIEW.   (DIAGRAMMATIC,
AFTER McBRIDE.)

a, Middle meatus.   *b*, Lower meatus.   *c*, Floor of nose.   *d*, Middle turbinal.
e, Septum.   *f*, Lower turbinal.

one generally begins an examination, because the most
important region of the nose—the middle meatus—is
thus examined first; and this is advantageous, because
the source of trouble is very often either situated in the

middle meatus or to be traced from it, and it is very
easy by tilting the patient's head still further back-
wards, and then bending it downwards to the horizontal
position, to complete one's survey of the anterior nasal
cavity.

The convex upper surface of the lower turbinated
body passes insensibly into the concavity of the outer
wall of the nose (Figs. 6 and 11). This concavity forms
the lateral boundary of the middle meatus, and over-
hanging the meatus above to a variable extent will be
seen the middle turbinated body or middle turbinal.
This body is seen to be somewhat paler in colour than
the lower turbinal, and the mucosa which covers it is
normally smooth and shining. The part of the body
which comes into view in this position is the ' head,'
bounded by an anterior border which is more or less
vertical in direction, and an inferior border which is
horizontal—parallel with the floor of the nose (Fig. 11).
By tilting the head still farther backwards the smooth
rounded anterior border can be traced upwards to a
point where it narrows to a constricted neck, which
joins the outer wall of the nose at an acute angle. The
lower border is broad and rounded, and may be followed
back for a variable distance, but the view which can
be got of this body depends very much upon the con-
formation of the septum. A deflected septum may
conceal it from view entirely, or to a great extent, and
much the same effect is produced when the tubercle of the
septum* is highly developed.

The middle meatus is that part of the nose which lies
between the middle and lower turbinals ; its outer wall

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* The tubercle of the septum is a collection of glandular
tissue situated nearly opposite to the anterior border of the
middle turbinal.

c   d

e

f

b

g

a

Fɪɢ. 11.—Vᴇʀᴛɪᴄᴀʟ Aɴᴛᴇʀᴏ-ᴘᴏsᴛᴇʀɪᴏʀ Sᴇᴄᴛɪᴏɴ ᴏғ Hᴇᴀᴅ. Tʜᴇ Sᴀᴡ ᴡᴀs ᴄᴀʀʀɪᴇᴅ ᴛᴏ ᴛʜᴇ Lᴇғᴛ ᴏғ ᴛʜᴇ Mᴇsɪᴀʟ Pʟᴀɴᴇ sᴏ ᴀs ᴛᴏ ᴀᴠᴏɪᴅ ɪɴᴊᴜʀɪɴɢ ᴛʜᴇ Sᴇᴘᴛᴜᴍ. Tʜᴇ Sᴇᴘᴛᴜᴍ ʜᴀs ʙᴇᴇɴ ᴅᴇᴛᴀᴄʜᴇᴅ ᴏɴ Tʜʀᴇᴇ Sɪᴅᴇs, ᴀɴᴅ ᴛᴜʀɴᴇᴅ ᴜᴘ ʟɪᴋᴇ ᴀ Lɪᴅ, ᴀɴᴅ ᴛʜᴇ Oᴜᴛᴇʀ Wᴀʟʟ ᴏғ ᴛʜᴇ Rɪɢʜᴛ Nᴀsᴀʟ Fᴏssᴀ ɪs ғᴜʟʟʏ ᴅɪsᴘʟᴀʏᴇᴅ. (Oʀɪɢɪɴᴀʟ Dɪssᴇᴄᴛɪᴏɴ.)

a, Vestibule.   *b*, Meatūs: Superior, middle, inferior.   *c*, Septum turned up. *d*, Oblique septum dividing sphenoidal sinus.   *e*, Spheno-ethmoidal recess. *f*, Three turbinals : Superior, middle, inferior.   *g*, Posterior edge of septum.

In front, close to the entrance of the nostril, part of the dark cavity of the vestibule is seen, and behind it is the inferior turbinal, which is shown in its entire length. The anterior part or atrium of the middle meatus is occupied by a depressed and pitted cicatrix, which extends downwards in a triangular form from the neck of the middle turbinal. The man from whom the head was taken suffered from chronic empyema of the antrum, and this cicatrix marks the place where pus used to lodge and crust. The concavity of the outer wall of the middle meatus is well shown. The middle turbinal has been divided in three places, but the segments have been replaced in position so that the body appears entire. Above the middle turbinal is the superior meatus and the short superior turbinal, and above and posterior to these structures is the large dark cavity of the sphenoidal sinus, which shows an oblique partition partly removed in cutting the section. Between the anterior wall of the sphenoidal sinus and the two upper turbinals is the spheno-ethmoidal recess, which is continuous with the superior meatus. Behind the posterior edge of the septum is the naso-pharynx : the dark shadow is on Rosenmüller's fossa, and the lighter part in front is the Eustachian cushion.

is concave, but this concavity is concealed more or less completely by the middle turbinal, which reaches downwards till it almost seems to overlap the lower turbinal where it is attached to the outer wall. In front of the middle turbinal there is a smooth open space on the outer wall of the nose. This space is called the atrium of the middle meatus, and towards its upper part there is (Fig. 11) a convex prominence called the *agger nasi*. The most important region of the middle meatus, however, is that which is hidden from view by the anterior part of the middle turbinal, which covers it as with a lid ; hence this part of the turbinal is called the *operculum*, a convenient and expressive name including roughly a triangular piece of the turbinated body—an isosceles triangle with its apex at the anterior angle of the body, and its base extending from the neck to the lower border.

If the middle turbinal be turned up out of the way, as has been done in the preparation depicted in Fig. 12, the first thing that strikes the eye is a well-marked gap or fissure in the outer wall of the middle meatus. This fissure—the *hiatus semilunaris*—is seen to begin about 1 centimetre above and behind the point where the neck of the middle turbinal is attached to the outer wall of the nose. It runs downwards and backwards in a semi-lunar or scimitar-shaped curve, and the concavity of the curve is directed upwards and backwards. The hiatus averages from $\frac{1}{2}$ to $\frac{3}{4}$ inch in length, and it ends opposite a point which lies about halfway between the anterior angle and the posterior end of the middle turbinal, from $\frac{1}{4}$ to $\frac{1}{3}$ inch above the level of its lower border. The hiatus is sometimes described as a groove, but the groove is really the continuation of the infundi-bulum, and the hiatus, as its name expresses, is the
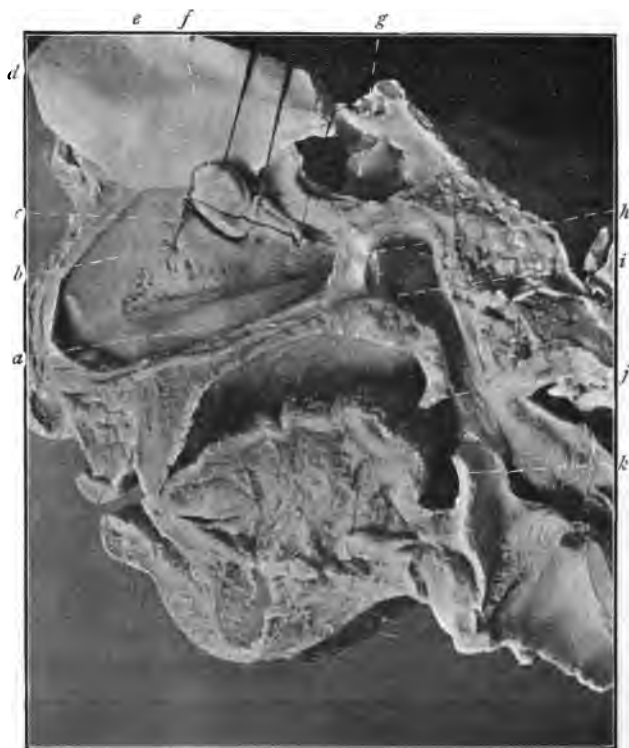
FIG. 12.—THE OUTER WALL OF THE RIGHT NASAL CAVITY.
(ORIGINAL DISSECTION.)

a, Inferior turbinal.   *b*, Unciform process.   *c*, Cut edge of the middle turbinal.
d, Hiatus semilunaris.   *e*, Bulla ethmoidalis.   *f*, Middle turbinal.   *g*, Partition dividing sphenoidal sinus.   *h*, Vomer.   *i*, Eustachian tube.   *j*, Uvula.
k, Epiglottis.

The septum has been detached on three sides and turned up, but the posterior part of the vomer has been left intact. The middle turbinal has been divided in front (at the neck), turned up, and secured in position by threads attached to its lower border. In doing this the bone of the turbinal has of course been fractured along its line of attachment to the outer wall. The hiatus semilunaris shows as a dark fissure running downwards and backwards, and between the hiatus and the fractured edge of the turbinal is the elongated swelling of the bulla ethmoidalis. Below and in front of the hiatus is the pitted cicatrix, better shown in Fig. 13, and lower down is the convex inner and upper surface of the lower turbinal. The free border of the inferior turbinal is concealed in this view by the cut edge of the septum. Compare Fig. 11.

gap or fissure which leads into the groove of the infundi-
bulum. It is, in fact, the natural entrance to or exit
from the infundibulum, and it varies in width from a
mere slit to a fissure several millimetres broad. Its
lower edge, formed by the unciform process of the
ethmoid, is sharp and smooth, and projects slightly
upwards and inwards, so that it overhangs the con-
cavity of the middle meatus (Fig. 5, *b*). This concavity
ends, in fact, at the edge of the unciform process. Above,
the hiatus is bounded by a smooth bulging ethmoidal
cell, called on account of its size the *bulla ethmoidalis*
(Figs. 12 and 13). It is evident from what has been said
that any considerable swelling of the parts adjacent to
the hiatus will close the gap and convert the groove of
the infundibulum into a tube. This, indeed, frequently
happens in acute inflammatory conditions, and leads
to the temporary damming up of secretion from cavities
which normally drain from the infundibulum through
the hiatus semilunaris. The cavities which drain in
this way are : (1) The frontal sinus, above and in front
through the ostium frontale ; (2) the antrum of High-
more, below and behind through the ostium maxillare ;
(3) the anterior ethmoidal cells, which open above the
middle part of the groove between the two ostia. In
the preparation shown in Figs. 12 and 13 a probe passed
forwards and upwards, continuing the direction of the
hiatus, would enter the frontal sinus ; passed downwards
and backwards it would enter the antrum just at the
bend of the curve.

The cavities just mentioned are grouped together
for diagnostic purposes as the *anterior group of sinuses*
or the *cells of the middle meatus*, and when they sup-
purate the pus drains into the infundibulum and escapes
through the hiatus, appearing in the nose anteriorly

in the middle meatus at the lower border of the middle
turbinated body.   The depressed and pitted cicatrix
seen in Figs. 12 and 13 was caused by the long-con-

Fig. 13.—The Right Middle Meatus, showing the Hiatus
Semilunaris and the Bulla Ethmoidalis. (Slightly
Enlarged.   Original Dissection.)

a, Broken edge of bone where the middle turbinal has been detached in front.
b, Hiatus semilunaris.   *c*, Two segments of middle turbinal turned up : u. p. =
unciform process ; B = bulla ethmoidalis.   *d*, Opening of bulla.   *e*, Vomer.
f, Inferior turbinal.

The middle turbinal has been detached in front and divided
into three segments.   The two anterior segments have been
turned up, the posterior segment remains *in situ*.   The smooth
sharp lower lip of the hiatus (formed by the unciform process)
is well shown, and the rounded bulging upper lip (formed by
the elongated bulla).   The dark mark immediately above the
bulla is the opening which leads into its interior.   The convex
surface of the inferior turbinal is seen at the lower part of the
figure.

tinued lodgment of purulent discharge from one of this
anterior group of cavities, and it shows very well 'the
situation usually occupied by such discharge when it
tends to crust.   In about 10 per cent. of all cases the
maxillary antrum possesses a second opening somewhat
below and behind the hiatus at a point between the
divisions of the unciform process where the wall consists
only of mucous membrane.   Practically this accessory
opening is not of much importance.

Turning now to the inner border of the middle tur-
binated body, it will be seen that a varying amount of
space intervenes between it and the septum (Figs. 5
and 6).   As a rule there is merely a narrow chink of
which no complete view can be obtained.   This chink
is called the *olfactory fissure*, because it is the entrance
to the olfactory as distinguished from the respiratory
region of the nose.

In cases where the nasal cavity is roomy and the
olfactory fissure comparatively wide it is sometimes
possible to catch a glimpse of the anterior arch of the
choanæ as it springs from the side of the septum.   As
seen from the front the arch is a double one, the two
arches springing together from the side of the septum,
and diverging like the ribs on a groined roof (Fig. 14)
till they are hidden by the middle turbinal.   This
glimpse of the anterior choanal arch is a very character-
istic view, and forms a definite landmark guiding one
to the anterior surface of the sphenoid, which lies just
above it.   The mucous membrane covering these arches
is normally considerably paler in colour than the sur-
rounding parts ; it is thin and closely applied to the
bone, which shines white through the mucous membrane.
When the parts are inflamed this light colour disappears,
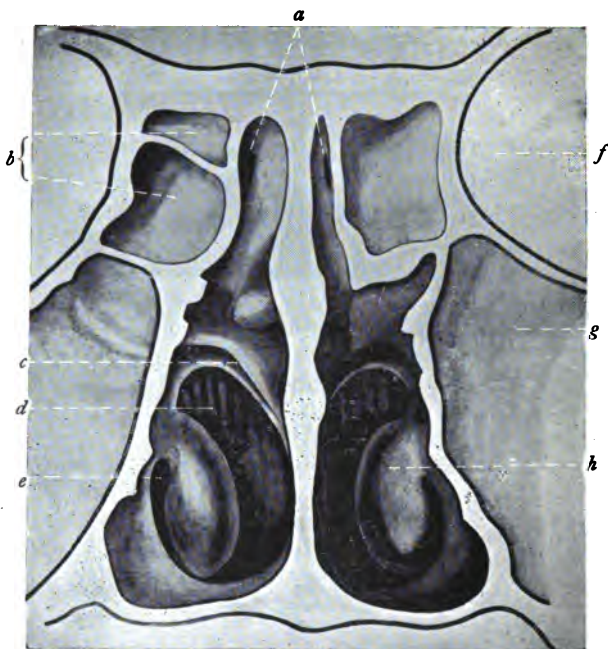but it is often present, and is, of course, best seen when

FIG. 14. — TRANSVERSE VERTICAL SECTION. THROUGH THE POSTERIOR PART OF THE NASAL CAVITY, JUST IN FRONT OF THE POSTERIOR NARES. THE VIEW IS STRAIGHT BACK INTO THE NASO-PHARYNX. (AFTER ZUCKERKANDL.)

a, Sphenoidal ostia. *b*, Posterior ethmoidal cells. *c*, Choanal arch. *d*, Pharyngeal tonsil. *e*, Ostium tubæ. *f*, Orbit. *g*, Antrum. *h*, Tubal swelling.

On each side of the septum below are the posterior nares, above is the body of the sphenoid. The posterior nares are bounded superiorly on each side by two folds of mucous membrane, which form the anterior choanal arch. Below and laterally is seen the rounded bulging of the tubal swelling in the concavity of which lies the opening of the Eustachian tube. On the posterior wall of the naso-pharynx, and just showing below the anterior choanal arch, are the vertical ridges and furrows of the lower part of the pharyngeal tonsil. Above the posterior nares is the body of the sphenoid, presenting at its upper part the (in this case) slit-like openings of the sphenoidal sinuses.

the middle turbinal is atrophic. A good view of the anterior choanal arch may be taken as indicating considerable atrophy of the turbinals, both lower and middle (see p. 65), but, as already said, a glimpse of the septal part of the arch is occasionally obtainable in a normal nose (Fig. 15).

Immediately above the choanal arch lies, as we have seen, the anterior surface of the sphenoid. It is not
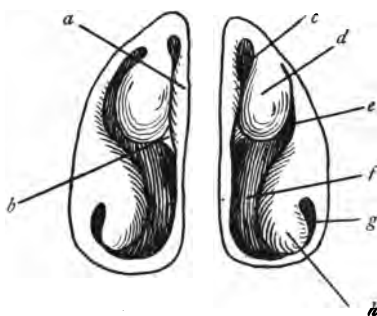

FIG. 15.—ANTERIOR RHINOSCOPIC VIEW IN A ROOMY NASAL
CAVITY. (SEMI-DIAGRAMMATIC, AFTER GERBER.)

a, Septum.   *b*, Anterior arch of choana.   *c*, Olfactory fissure.   *d*, Middle
   turbinal.   *e*, Middle meatus.   *f*, Posterior wall of pharynx.   *g*, Inferior
   meatus.   *h*, Inferior turbinal.

A considerable extent of the posterior pharyngeal wall is visible on both sides, and the beginning of the anterior choanal arch can be seen as it springs from the side of the septum and disappears behind the middle turbinated body.

of a very deep red colour unless inflamed, and being at right angles to the line of sight it often shows a glistening reflection. The ostium is at the upper part, and is only visible in cases of marked atrophy (old suppuration), or when the greater part of the middle turbinal has been removed. If the olfactory fissure

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be paced with absorbent wool soaked in a solution of cocain (10 per cent.) and adrenalin (1 in 10,000), a partial view of the sphenoid may generally be obtained after the operculum has been removed.

To find the ostium with a probe it is recommended to pass it from the anterior nasal spine across the middle of the middle turbinal. When, as in most cases, a large part of that body has already been removed this direction is not applicable. The usual tendency is to go too low. A line drawn from the anterior nasal spine to the sphenoidal opening would, if prolonged, pass well above the level of the top of the auricle. This is a useful hint, the accuracy of which the writer has many times verified.

The sphenoidal sinus opens into the spheno-ethmoidal recess (Fig. 11), and when the sinus is the seat of suppuration some of the discharge finds its way into the olfactory fissure, but by far the greater part of it runs downwards and backwards under the choanal arch to the naso-pharynx, where it may be seen with the post-nasal mirror on the upper part of the vault, at the upper edge of the posterior nares, coating the upper surface of the middle turbinal, and sometimes trailing down on to the soft palate.

The posterior cells of the ethmoid open into the superior meatus, and pus from them follows the same course as that from the sphenoid. Thus the posterior ethmoidal cells and the sphenoidal sinus form the *posterior group of accessory sinuses* or *cells of the superior meatus*, which discharge into the naso-pharynx.

Common Morbid Changes in the Nose.

Observe first the external configuration, noting any absence of symmetry in shape, or deflection of the

organ to one side such as frequently follows a blow, especially in early life.

Redness of the tip or of the ala of the nose is apt to give rise to the suspicion of alcoholism, but in many cases it has nothing whatever to do with drink, and is simply a reflex congestion due to some intranasal irritation.

The alæ or wings of the nostrils are moderately expanded when the nose is fulfilling its function as a breathing organ, whilst in cases of old-standing nasal obstruction (as from adenoids) the alæ are collapsed, and show sometimes a well-marked dimple on their outer surface in the interval between the upper and lower lateral cartilages. The entrance to the nostrils in such cases is narrow and slit-like. A fairly common cause of want of symmetry at the entrance of the nostrils is dislocation of the cartilage of the septum. The displaced anterior edge of the cartilage projects under the mucous membrane and narrows the entrance to the nostril. Sometimes, but rarely, the dislocated cartilage is split into its two component laminæ, and an edge projects on each side narrowing both nostrils.

Many cases of old nasal disease show certain changes in the face which are very suggestive. A minor degree of the deformity known as ' frog-face,' in which there is bulging and displacement of the nasal bones, is seen occasionally in bad cases of ethmoiditis with polypus formation ; but if the deformity be marked the cause will usually be found to be of a more serious nature, such as a fibro-sarcoma invading the nose from behind. In chronic ethmoiditis the nose often becomes broadened at the root, the space between the eyes being increased, and in old atrophic (suppurative) cases the bridge of the nose sinks somewhat, and the

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nostrils look slightly forward instead of directly down-
wards. The eyes are frequently congested and watery
in cases of ethmoiditis, the sight is weak, and it is in
the writer's opinion extremely probable that the growth
and development of the eyeball may be considerably
prejudiced by the existence of this disease in young
subjects.

Cracks and excoriations about the entrance of the
nose, or an eczematous condition of the skin, are generally
due to the presence of an irritating discharge—pus or
muco-pus in chronic cases. Such a discharge is very
common in cases of adenoid growths in children, but
in adults it is generally due to suppuration in the
accessory sinuses.

Painful little boils sometimes form in the tip of the
nose, usually in the anterior recess of the vestibule,
which is best examined with the small post-rhinoscopic
mirror, and without the use of a speculum. The other
parts of the vestibule may be inspected by simply
raising the tip of the nose with the thumb.   Immediately
within the nostril a smooth round hole is sometimes
seen at the anterior and lower part of the septum.
This is the mark of the simple perforating ulcer of the
septum.   It is due to the oft-repeated irritation caused
by picking off a crust, and is thus a simple traumatic
ulcer. During its formation the patient feels some
irritation at the spot, and notices that his finger-nail is
blood-stained ; but when healed it gives rise to no
symptoms, and the patient is usually unaware of its
existence.

In this region is the 'bleeding spot' which is the
usual source of hæmorrhage in epistaxis; and here,
also, is found the 'bleeding polypus of the septum '—
a small angioma of rare occurrence. Multiple papillo-

mata (warts) are met with in the vestibule and about the entrance of the nostril : they are sometimes mis- taken for epithelioma, and *vice versa.*

The normal rhinoscopic appearances may be altered in many different ways, but the great majority of the commoner changes are capable of being arranged very simply.

The erectile tissue plays a very important part in minor and functional nasal troubles; it is very frequently congested, and it may also be collapsed.

The bulk of the more serious nasal diseases, however, are due to inflammatory hyperplasia, affecting chiefly the ethmoid bone and its coverings. These hyperplastic changes may be simple enlargements, or ' hypertro- phies ' as they are called, or they may assume the form of polypi. When complicated by the advent of suppuration the condition becomes more troublesome. The pus causes secondary infections of the throat, larynx, and trachea, the stomach suffers from the ingestion of septic matter, and the occurrence of caries or necrosis is liable to lead to the invasion of neigh- bouring cavities—the cranium and the orbit. Even if the patient escape these last-mentioned dangers, continued suppuration increases the hyperplastic changes. Suppuration stimulates the growth of polypi and hypertrophies, and these growths in their turn interfere with drainage, and so aggravate the suppura- tion. In a later stage of suppuration—that of crusting —atrophy sets in, and progresses, till in extreme cases all the important structures in the nose have practically disappeared. It is proposed in the following pages to trace this brief outline a little more in detail.

One of the commonest symptoms of which patients complain is ' stuffiness ' (which is really their description

of nasal obstruction), and the most frequent cause of 'stuffiness' is congestion of the erectile tissue, which, as we have seen, is distributed chiefly on the inferior turbinated body. In the case of a cold in the head the turbinal engorgement is inflammatory, and due to acute catarrh; but in a large class of chronic cases there is no trace of inflammation, and the congestion is entirely a vaso-motor phenomenon. In such a case the nose may appear perfectly normal on inspection, and in nervous patients—especially women—the turbinals may even appear shrunken and collapsed, quite as much so sometimes as if they had been cocainized. The patient will tell you, however, that she suffers from 'stuffiness,' which varies at different times, now one nostril being blocked and again the other. It is worse on lying down, as at night; the dependent nostril is generally the worst, and the mouth is dry on waking in the morning. Active exercise, especially pleasurable exercise such as dancing, often relieves or entirely removes the stuffiness.

If the nose be inspected after the patient's nervousness has passed off, the lower turbinal on one or both sides will be seen to be swollen, lying very likely in contact with the septum and blocking the meatus. When pressed with a probe the swollen turbinal feels like a bag of liquid, filling out instantly when pressure is removed. If cocain be applied to the congested parts they quickly shrink, and this test completes the diagnosis.

In contrast to this state of turbinal engorgement is the condition of collapse of the erectile tissues as it occurs in some delicate and anæmic persons, especially women. The nasal fossæ appear wide, and the mucous membrane of the nose, but more especially of the posterior wall of the pharynx, is abnormally dry and glazed-looking, as if it had been covered with a coat of varnish.

Turbinal engorgement is in the main a local disorder, curable by local means, but turbinal collapse is essentially the expression of a constitutional state, curable only by general treatment.

Combined with vascular engorgement there is often a good deal of permanent thickening or hypertrophy of tissue, the result of chronic rhinitis, and this can only be partly reduced by cocain. The hypertrophy may be fairly uniform, and the lower turbinal sometimes presents a somewhat wrinkled or corrugated aspect; The enlargement is most apparent in the head of the turbinal because it is the part most easily seen, and it is also the part which gives rise to the most obvious symptoms by blocking the narrow anterior naris—the prow of the boat (see p. 30).

Multiple growths are sometimes seen fringing the lower border of the turbinal and tucked away into its concavity. They are associated with chronic inflammatory irritation, and are sometimes typically papillomatous in form. Very frequently the posterior end of the turbinal is affected, and forms a more or less globular enlargement, which is often œdematous, and has a slightly constricted neck. In colour this posterior hypertrophy, as it is called, is generally of a light bluish-gray, like a polypus; but its surface is not usually smooth like that of a polypus, being covered with little projections, which, however, may be obliterated by a tense œdema. In chronic cases the swelling often resembles a raspberry in shape, and hence the name 'raspberry hypertrophy'; or, again, it may be very vascular and purplish from enlarged veins, and is then called a 'mulberry hypertrophy.'

Posterior hypertrophies cannot as a rule be seen from the front, but they are often easily seen with the post-

nasal mirror. Probably this is because they press upon the soft palate, and produce a paretic condition of the muscles which is favourable to examination. It is fortunate when they are easily seen, for frequently they cannot be felt by the finger in the naso-pharynx, even when they are of considerable size. They retreat in front of the finger-tip and are difficult to make out. Sometimes a posterior hypertrophy acts like a ball-valve in the nostril, moving backwards to allow the inspiratory stream to enter the naso-pharynx, and being blown forwards into the nostril by the expiratory stream, blocking the channel completely. This ball-valve sign is very suggestive of posterior hypertrophy. It might, of course, occur with a polypus, but some part of the polypus would almost certainly be visible from the front.

Hypertrophy, or, to be more exact, inflammatory hyperplasia of the *middle* turbinated body, shows itself most frequently by enlargement of the anterior end, or ' head,' which is seen lying against the septum, and filling the space between it and the outer wall of the nose. The enlargement may be tolerably uniform, and involve both bone and mucous membrane; but often the latter is most evident, and the mucous membrane forms a sort of pendulous flap, red and granular-looking or pale and œdematous, hanging down over the middle meatus. The probe will show at once how much of the enlargement is bony. Seeing that the middle turbinal is part of the ethmoid, this hyperplasia is really an ethmoiditis, which may be limited to the middle spongy bone and its coverings or affect the ethmoidal cells as well.

When the head of the middle turbinal is much en-larged the bone will nearly always be found to be

hollow, containing in its interior one or more cells communicating with the nose, or possibly a bone-cyst of considerable size which does not so communicate.

Instead of a simple and tolerably uniform enlargement the student will frequently find a number of pedunculated œdematous growths crowded up near the neck of the middle turbinated body and fringing its lower border, or bulging out from beneath the turbinal and pushing it over against the septum.

These polypoid growths, or polypi, are generally of a pale-gray or bluish-gray colour. When active inflammation is going on they become more vascular and reddish, but the predominant colour is pale gray.

When a piece of hyperplastic nasal mucous membrane grows out from its base it expands in the direction of least resistance, and becomes first œdematous, then pedunculated, and finally a polypus. The great majority of nasal polypi own this origin; they are inflammatory outgrowths whose form is determined by the physical conditions of the bony chambers in which they grow. They grow downwards because it is the direction of least resistance, and in a marked case the nostril is blocked by a pale gray œdematous mass composed of growths so crowded together that the individual polypi can only be imperfectly distinguished. That the great majority of polypi are of inflammatory origin there is no doubt, and it is now generally acknowledged that the bony framework of the ethmoid is usually inflamed as well as the mucous membrane. Where the process starts is uncertain. The nasal mucosa is so much exposed to irritation, and so frequently inflamed, that it seems natural to assume it as the starting-point; but there may possibly be other factors of which our knowledge is imperfect.

The point to be borne in mind is that nasal polypi
nearly always mean ethmoiditis. It is true, as we
have just seen, that there may be ethmoiditis even of
long standing, showing itself in chronic enlargement of
the middle turbinated body and cells, without polypi ;
but in such cases the inflammatory hyperplasia, although
it assumes a somewhat different form, is always suffi-
ciently obvious.

As the two ethmoids form practically one bone, it is
not surprising to find that in cases of inflammation
both sides are very commonly affected. Ethmoiditis
is thus most frequently a symmetrical disease.

Nothing has been said about suppuration, because
that is to be regarded as a complication due to pyogenic
infection of the cells—a superadded factor, which, in
many cases at least, has nothing to do with the essence
of the process, however profoundly it may modify it
from the point of view of prognosis and treatment.
No doubt an ethmoiditis may be suppurative from the
first, and directly due to pyogenic infection of the cells,
as in the form caused by influenzal rhinitis ; but that
is another matter, and does not affect the truth of the
contention advanced above.

Nasal polypi and suppuration frequently co-exist,
and mutually aggravate each other, the suppuration
stimulating the growth of polypi, and the polypi im-
peding the escape of pus. Though frequently found
in conjunction, however, either may exist without the
other. Polypi may persist for many years without a
trace of suppuration, but chronic suppuration probably
always leads at some period of the case to the develop-
ment of polypoid growths.

From a practical point of view, the presence or absence
of suppuration is extremely important, for it usually

makes all the difference between a comparatively simple case and a tedious and troublesome one. When suppuration is present, it becomes the main thing, whether it was originally present as the cause of the ethmoiditis, or was added as a complication to a case of ethmoiditis which was perhaps already of old standing.

The posterior end of the middle turbinal occasionally shows a globular enlargement, somewhat similar to that seen on the inferior, but it is much less frequent. The posterior end of the bone is also subject to thickening and distortion as a result of chronic ethmoiditis (see p. 69).

The commonest bone change in the ethmoid is rarifying osteitis, the bone being thinned and brittle in some parts, and thickened or eburnated in others.

Caries in the nose most frequently affects the ethmoid, and is always associated with profuse suppuration ; but there are many cases of suppuration of the most chronic character in which no caries can be detected even by careful examination.

Necrosis in the nose is nearly always syphilitic, and the septum is a favourite site, especially the vomer and adjacent part of the sphenoid, but no part of the bony framework is exempt. Necrosis apart from syphilis is rare, but it does occur, and may even affect the spongy bones.

Apparent Doubling of the Middle Turbinal.

Another structure on the outer wall of the nose which is liable to inflammatory hypertrophy is the unciform process, more especially the soft parts which cover it. This hypertrophy is caused by the continual oozing of

pus from the hiatus semilunaris, such as occurs in chronic suppuration of one or more of the anterior group of sinuses (see p. 45). It has been seen that the unciform process forms the lower lip of the hiatus semilunaris, and is normally overlapped by the middle turbinated body. When the mucosa of the unciform process hypertrophies it forms a thick fleshy cushion, which presses against the adjacent surface of the middle turbinal and produces an appearance exactly as if that body were duplicated or cleft lengthwise. Hence the phrase ' cleavage of the middle turbinal ' first employed by Woakes. A bent probe passed into the cleft between the two apparent turbinals enters the hiatus semilunaris, but no probe can be passed external to the outer swelling, seeing that it is part of the outer wall. This is the way in which apparent doubling of the middle turbinal is generally produced—by enlargement of the lower lip of the hiatus semilunaris.

The same appearance of duplication may be produced by enlargement of the upper lip of the hiatus—viz., the smooth bulging bulla ethmoidalis. This is quite a rarity as compared with hypertrophy of the unciform process, but it must be kept in mind as a possibility. Enlargement or distension of the bulla of one side suggests the presence of pus inside it. Symmetrical enlargement of the bulla in both nostrils occurs as a physiological abnormality, although it is, of course, conceivable that it might occur in a case of bilateral disease. A probe passed into the hiatus in these cases will determine the nature of the swelling. It can only be passed *above* the unciform process, and only *below* the bulla.

A third way in which apparent doubling of the middle turbinal is sometimes produced is by œdema

of the mucous membrane covering its outer (concave) surface. Being more loosely attached than the mucous membrane on the inner surface it bulges downwards, and appears at the lower border of the turbinal as an œdematous swelling, lying apparently between the turbinal and the outer wall. When removed such a specimen will be found to show quite a shallow groove.

If the operculum have been removed in a case in which the unciform process is much hypertrophied, the latter will come to lie in contact with the septum, and thus simulate exactly the appearance of the normal middle turbinal ; but the probe will make the matter clear at once : It cannot be passed between the swelling and the outer wall.

In very chronic suppuration the bony lamina of the unciform process is occasionally greatly hypertrophied. Instead of the normal smooth outline, it presents an irregular nodular appearance, and as the middle turbinal is generally much atrophied in such cases, this thickened, rounded, knobby edge of bone overhanging the middle meatus lies in close contact with the septum, and impedes very seriously the escape of discharges from the upper regions of the nose. Sometimes the hypertrophied unciform process becomes adherent to the adjacent lower border of the middle turbinal, which in process of atrophy has shrunk up to the same level. The adhesion may be practically complete, so that a kind of arch is formed reaching from the outer wall to close against the septum, but more frequently a probe can be passed between the two structures, at least in places. In either case the interference with drainage is considerable.

Hyperplastic processes on the septum are of

less importance than those affecting ·the turbinals. The tubercle of the septum has been already alluded to. When enlarged it hides the head of the middle turbinal and the olfactory fissure more or less completely.

Posteriorly, on each side of the edge of the vomer the mucous membrane of the septum sometimes shows a considerable degree of thickening, which appears in the mirror as a triangular swelling of a pale pinkish colour. Marked hyperplasia of the mucous membrane of the septum is seen in some cases of necrosis and in hypertrophic rhinitis. The mucosa may form over-hanging wrinkles or folds, or project as a broad-based swelling, which may in time assume a polypoid shape.

Cartilaginous ridges on the septum near the floor of the nose have also been referred to, and deflections of the cartilage. A pronounced deflection is generally thickened over the convexity, and this thickening is sometimes so pressed against the lower turbinal as to cause it to atrophy over the compressed area.

Having considered hyperplasia, let us next glance at

Atrophic Changes.

Atrophy in the nose is practically always the result of long-continued suppuration. It is seen in its most pronounced form in old cases of ' ozæna,' and affects all the intranasal structures. The mere irrigation of the surface of the mucous membrane with pus, however, will not cause atrophy. On the contrary, such irriga-tion is a very frequent cause of hypertrophy ; and again, it is not uncommon to see in the same nostril atrophy of some structures and hypertrophy of others. Where this is the case, it will be found that the atrophic parts are near the floor of the nose, and the hypertrophic

parts higher up the cavity. The lower turbinal may be markedly atrophied, while the middle turbinal is still hypertrophied. Thus atrophy in the nose is an ascending process, and it only occurs in the later stages of very chronic suppuration, when the discharge has diminished in amount, and consists largely of crusts of fœtid decomposing pus, which adhere closely to the mucous membrane. The atrophy is probably partly
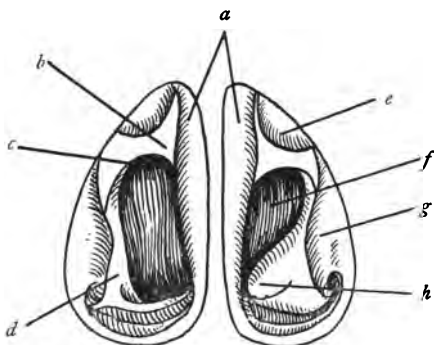
FIG. 16.—ANTERIOR RHINOSCOPIC VIEW AS SEEN IN AN ATROPHIC NOSE. (SEMI-DIAGRAMMATIC, AFTER GERBER.)

a, Septum.   *b*, Body of sphenoid.   *c*, Anterior choanal arch.   *d*, Eustachian cushion at rest.   *e*, Middle turbinal.   *f*, Posterior wall of pharynx.   *g*, Inferior turbinal.   *h*, Eustachian cushion (during phonation).

the result of pressure, and partly of that interference with nutrition which must result from the close continuous contact of such putrid decomposing masses with the delicate mucous membrane.

Crusting naturally occurs first in the lower parts of the nasal cavity, and affects the lower turbinals. In extreme cases they disappear entirely, or remain only as a slight ledge on the outer wall along the line of attachment of the lower spongy bone. The back wall

of the naso-pharynx is thus fully exposed, and may be
seen dusky red, coated with pus in parts, or dry and
glazed with a thin film of dried secretion. The action
of the palatal muscles during phonation and deglutition
can be well seen and studied in such cases. The most
noticeable movement is that produced by the contrac-
tion of the levator palati, which causes the mucous
membrane to rise like a cushion in front of the Eus-
tachian opening. The opening of the tube also moves,
however, the projecting part of the trumpet-shaped
cartilage moving downwards and inwards towards the
middle line. This movement is caused by the contrac-
tion of the salpingo-pharyngeus, which arises from the
Eustachian cartilage, and is inserted into the pharynx.
These contractions are simultaneous and quite momen-
tary, reminding one rather in their character of a rapid
grimace. Deglutition shows them better than phonation.

Atrophy of the middle turbinated body is a later
phenomenon, and, bearing in mind what has been said
above, its mode of production is not difficult to under-
stand. The lower border of the middle turbinal in its
anterior half is frequently enveloped in a closely-fitting
crust, formed by pus which oozes slowly from the hiatus;
and when the posterior sinuses are diseased the inner
(septal) surface of the turbinal is generally coated with
a thin layer of half inspissated pus, which stagnates
more or less in the olfactory fissure, and although it
never forms a hard crust in that situation—hard enough,
that is, to exert injurious pressure—yet its influence
upon the nutrition of the turbinal cannot fail to be
the reverse of beneficial.

The first effect of wasting of the middle turbinal is
to expose to view the concavity of the middle meatus
(over which it normally hangs), bounded above by the

sharp edge of the unciform process. Sometimes a
wasted remnant of old hypertrophy is seen on the
unciform process, bearing witness to the earlier stages
of a very chronic suppuration which may have smoul-
dered out. Above the unciform process the bulla
comes into view—a smooth swelling of very varying
size—and when the middle turbinal is completely
wasted, the cells which form the roof of the middle
meatus as it arches across to the olfactory fissure are
also seen. Backwards the anterior choanal arch is
very distinctly visible, and above it the anterior surface
of the body of the sphenoid with the black slit or hole
of the ostium at its upper and inner part. When ex-
posed in its entirety, the anterior choanal arch is seen
to be double—that is to say, it consists of two arches,
which spring together from the side of the septum and
at first diverge, but finish their course by running
parallel down the outer wall of the nostril, the upper
arch ending in front of the lower. They remind one
very much in general outline of the arrangement of
the faucial arches in the mouth, the septum taking the
place of the uvula.

The complete arch is only seen when the atrophy of
the turbinals is very marked, but the inner or septal
part of it is very frequently visible when the middle
turbinal is small or moderately atrophied. On ex-
amining the nose after removing the middle turbinal
more or less completely, the first thing that strikes the
eye as new in the picture is often the whitish shining
mucous membrane which covers the diverging lines of
the choanal arch and the adjacent part of the septum.
Hyperæmia conceals the lines of the double arch, but the
fact that there is an arch can be made out easily enough.

The degree and extent of the wasting varies according

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to the site and nature of the disease which produces it ;
for example, the middle turbinal suffers most severely
in ethmoidal suppuration when all the cells are affected,
so that both its surfaces are continually crusted over
or soaked in pus—the inner surface by pus from the
posterior cells, and the outer surface by pus from the
anterior cells.   The two sides of the nose rarely show the
same degree of wasting in cases of bilateral disease, and
often there is a considerable difference.   On one side
the middle turbinal may have disappeared so com-
pletely that the middle meatus passes insensibly into
the olfactory fissure with hardly a ridge of demarcation,
and on the other side the middle turbinal may remain
as a fairly complete, though greatly wasted, lamina,
covered with a pale, unhealthy-looking mucous mem-
brane sodden with pus.   To the beginner in rhinology
no cases are more valuable as clinical studies than
those showing various degrees of atrophy.   All the
conditions of examination are simplified, and the
student will often learn more of nasal topography
from two or three such cases than from dozens of
difficult or ' interesting ' ones in which he really cannot
get his bearings.

Secretion.

The interior of a healthy nose is practically free
from visible secretion.   The mucous membrane is
smooth and moist, and mostly of a deep-red colour,
covered with a thin layer of invisible mucus.   Some-
times, especially when slight catarrh is present, threads
of mucus are seen stretching across from the septum
to the lower turbinated body.   This merely indicates
that the two surfaces have lately been in contact,
and that as the erectile tissue contracted and the

turbinal shrank away from the septum, the viscid mucus with which the surfaces were coated was drawn out into threads.

Most nasal discharges consist of mucus and pus in varying proportions. Large masses of pus with little mucus suggest an origin from some limited recess or accessory cavity ; pure pus, in the absence of ulceration, generally indicates empyema of an accessory cavity. The more liquid the secretion the more certainly it gravitates to the lowest point. During the day this is the floor of the nose, but at night it is often the sphenoidal sinus and naso-pharynx (when the patient is lying on his back), or the maxillary antrum (in certain lateral positions). This is the explanation of the fact that pus is not infrequently found in accessory cavities which are not themselves the seat of suppurative disease.

Suppurative nasal troubles centre, as a rule, in the ethmoidal cells, a group of irregular cavities with few natural facilities for drainage.

The anterior group of cells—those of the middle meatus—drain into the infundibular groove, and when this groove is well developed, as it usually is, it runs directly downwards and backwards to the opening of the antrum (Figs. 12 and 13), so that any pus from the anterior sinuses which does not overflow the groove and run down the middle meatus is almost certain to find its way into the antrum when the opening is patent.

The posterior ethmoidal cells open into the superior meatus, and pus from them, when the patient is lying on his back, inevitably drains into the spheno-ethmoidal recess, and covers the anterior surface of the sphenoid (Figs. 11 and 17).

The sphenoidal ostium is narrow and is placed quite at the upper part of the recess, close to the roof of the

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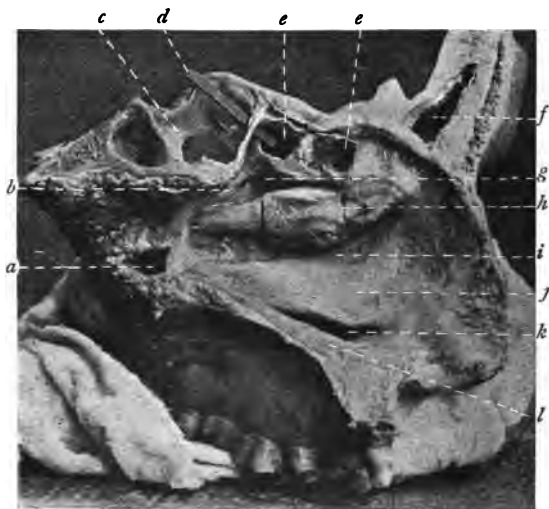
FIG. 17.—VERTICAL ANTERO-POSTERIOR SECTION OF THE NOSE IN A PLANE EXTERNAL TO THAT SHOWN IN FIG. 11. (ORIGINAL DISSECTION.)

a, Whalebone in Eustachian tube.   *b*, Interval between upper surface of middle turbinal and choanal arch.   *c*, Partition dividing sphenoidal sinus.   *d*, Whalebone in sphenoidal opening.   *e, e,* Ethmoidal cells broken open.   *f,* Frontal sinus.   *g,* Superior meatus.   *h,* Middle turbinal.   *i,* Middle meatus. *j,* Inferior turbinal.   *k,* Inferior meatus.   *l,* Section of hard palate.

The three turbinals are shown and the three meatūs ; the posterior part of the inferior meatus is concealed by the palate. The middle turbinal has been divided in two places, but the segments have been replaced in position so as to show the entire body.   Immediately above the middle turbinal is the superior meatus, and above that is the superior turbinal and the ethmoidal cells, which have been opened in two places.   A piece of whalebone has been passed through the sphenoidal ostium, and is pointing to the posterior ethmoidal cells.   The interval between the upper surface of the middle turbinal and the lower surface of the sphenoid is well shown.   The frontal sinus is seen in section, and a piece of whalebone has been introduced into the mouth of the Eustachian tube.

nose, but in old cases of atrophy it is sometimes con-
siderably enlarged, and pus from the ethmoid may
readily find its way into the sinus. A little pus escapes
through the olfactory fissure in these cases, but it is a
narrow space, easily blocked, and when the middle
turbinal is swollen it is practically obliterated ; and so
the only remaining exit for discharge from the spheno-
ethmoidal recess is backwards and downwards between
the upper surface of the middle turbinal and the choanal
arch (Fig. 17), which is formed by the body of the
sphenoid. In some cases the posterior end of the middle
turbinal is thickened and deformed in such a way as to
greatly narrow this exit,* the bone being thickened and
the mucosa œdematous, and the recess then becomes an
almost closed cavity with one narrow outlet, quite in-
sufficient for drainage in cases of free suppuration.
Thus, in suppuration of the posterior sinuses by far the
greater part of the pus drains into the naso-pharynx.
Pus from the sphenoidal sinus itself will probably appear
on the vault close to the upper part of the septum.
The reservoir action of this sinus was first demonstrated
ad oculos in vivo by Hajek.

A cavity which plays the part of a reservoir for pus is
very likely after a time to become diseased, but at pre-
sent we do not know with regard to those sinuses the
proportion in which their suppurations are primary or
secondary. The maxillary antrum is, of course, ex-
posed to infection from the roots of carious teeth, and
is therefore a likely enough seat of primary suppura-
tion, which may very well infect the ethmoidal cells;
but the frontal and sphenoidal sinuses would, from
their sheltered situation and simple structure, appear

* 'Ozæna,' by John Mackie, *Quarterly Medical Journal*, 1902.

a priori much less likely to suffer in this way. The frontal sinus, with its duct leading from the lowest point of the cavity, would seem to be most favourably situated as regards immunity from suppuration, and yet frontal suppuration is by no means rare. A probable reason is not far to seek. The duct of the frontal sinus runs actually through the anterior part of the ethmoid, and is surrounded by cells—the so-called infundibular cells—which are as frequently diseased as any part of the ethmoid, and are quite capable of infecting the lower part of the frontal sinus. The cells of the infundibulum become carious, exuberant granulations choke the passage, and pus accumulates above the obstruction in the lower part of the frontal sinus, which in time becomes diseased.

Thus, all the three large single sinuses of the nose— antrum, frontal, sphenoid—are subject more or less to the ethmoid, and liable under certain conditions to be infected by it.

The tendency to crust-formation in the nose depends partly upon the composition and quantity of the secretion, and partly upon its opportunities of stagnating in the air current till it loses sufficient water to become inspissated. A very profuse discharge never crusts ; it is in motion all the time, and stagnation is essential to crust-formation. It used to be supposed that in cases of marked crusting the secretion contained a special desiccative element, but the writer is not aware of any evidence in support of this view. The crusts in ' ozæna ' cases consist essentially of pus, dried and decomposing, and in many cases the pus originates in one or more of the nasal accessory sinuses, most frequently, perhaps, in the posterior ethmoidal cells.*

* Mackie, *Op. cit.*

The position of a crust in the nose is often indicative of the region or cavity which is furnishing the pus, and hence the situation should be carefully noted before the crust is removed.

The form of a crust which has been expelled some-times conveys useful information as to the situation in which it was formed. Thus, the flattened ' oyster-shell ' crust, which is frequently hawked up from the throat, is composed of pus which has stagnated on the posterior wall of the naso-pharynx ; and the boat-shaped crust which is expelled in some cases from the anterior nares is really a mould of the anterior end of the middle turbinated body, formed by pus oozing slowly from the hiatus semilunaris.

Ulceration in the nose may be due to various causes, of which the commonest are injury, syphilis, tubercle, lupus, and malignant disease.

1. The typical example of a traumatic ulcer is the simple perforating ulcer of the cartilaginous septum, the situation and appearance of which have been already described. It begins generally on the upper surface of a ridge on the septum where mucus tends to dry and form a little crust. The crust causes irritation, and is removed with the finger-nail. An excoriation is thus produced ; the crust re-forms and sticks closer than before, the surface being raw. It is again picked off, and the excoriation is increased, and so the process goes on till the septum is perforated, and a round hole with smooth edges is left permanently.

2. The syphilitic ulcer is caused by the breaking down of a gummatous deposit, which appears first as a swelling under the periosteum. The bony septum, especially the vomer, is a favourite site, but no part of the cavity is exempt. There is the usual grayish-

white, sloughy surface ; destruction is very rapid, and
there is great foetor. Some of the worst cases are
congenital.

3. Tubercular ulceration in the nose is, in the writer's
experience, very rare in England ; it is much commoner
in Austria and Germany. Masses of exuberant granula-
tions form, especially on the septum. The parts bleed
easily, and the case may present some resemblance to
sarcoma.

4. Lupus very frequently affects the skin as well as
the mucous membrane, and is then easily recognised.
It does not granulate exuberantly like tubercle. The
surface of the diseased mucosa is soft, and can be cut
away in strips with a ring-knife, and it does not bleed
very freely.

5. Malignant disease in the nose is sometimes accom-
panied by a free discharge of offensive pus. This occurs
in some cases of epithelioma of the antrum, and may
lead to mistakes in diagnosis. A vascular-looking
growth presenting at the anterior nares suggests sar-
coma, and the same possibility should be kept in mind
when one sees what is apparently an abundance of
granulation tissue without a corresponding amount of
pus.

The nasal passages are insufficient for breathing pur-
poses in a good many persons who exhibit none of the
morbid nasal conditions just indicated, but in whom
there is a general narrowness of the bony framework of
the nose, which is frequently high in the bridge and of
the aquiline type. There may be no redundancy of
soft tissue and no undue projection of bone or cartilage,
but the chambers are built narrow, so that very slight
degrees of swelling produce marked obstruction. Many
of these are old adenoid cases in which the adenoids

have disappeared, leaving behind them their legacy of
characteristic deformities, too often irremediable ; and
others are due to rickets in early life, and possibly to
congenital syphilis interfering with the normal develop-
ment of the upper jaw.

FIG. 18.—VERTICAL ANTERO-POSTERIOR SECTION OF HEAD, IN A
   PLANE EXTERNAL TO THAT SHOWN IN FIG. 17, SHOWING
   FRONTAL ETHMOIDAL AND SPHENOIDAL CAVITIES IN SERIES.

a, Epiglottis.   *b*, Uvula.   *c*, Eustachian cushion.   *d*, Posterior part of the
   middle turbinal.   *e*, Partition dividing sphenoidal sinus.   *f, f, f*, Ethmoidal
   cells.   *g*, Frontal sinus.   *h*, Unciform process.   *i*, Middle meatus.   *j*, In-
   ferior turbinal.   *k*, Inferior meatus.

In children, and in insane persons, foreign bodies are
sometimes introduced into the nose, and give rise to
obstruction, together with a unilateral discharge of
fœtid pus.   A rhinolith or nasal stone causes the same
symptoms, but in a child the discharge of fœtid pus

from one nostril nearly always indicates the presence of a foreign body.

From what has been said in the preceding pages, the writer thinks it will be evident that he regards the ethmoid as the key to the nose, and the various forms of ethmoiditis, with and without suppuration, as constituting by far the most important chapter in nasal pathology.

During the last twenty years surgery as a science has advanced enormously. As an art its sphere of usefulness has so extended that there is now no organ of the body which is beyond its reach, and *pari passu* with this advance surgical principles and ideas have become simpler and more intelligible.

The writer trusts that some of his readers may find their ideas of nasal pathology simpler and clearer from the perusal of this sketch.

THE EXAMINATION OF THE LARYNX

For the examination of the larynx two laryngoscopic
mirrors will suffice for almost all cases.   A large size is
best as a rule (1 inch or 1⅛ inches in diameter), but a
smaller size (¾ inch to ⅞ inch) may be required when
the tonsils are enlarged, and in children.   A laryngeal
probe (German silver) and a cotton carrier with the
same curve as the probe may also be needed for palpa-
tion and for the application of cocain.

The surgeon should be seated facing his patient on a
somewhat higher chair.

Having briefly explained to the patient the method
of proceeding, he is directed to put out his tongue, and
the surgeon grasps it with a piece of cotton cloth held
between the forefinger and thumb of his left hand.   An
oblong piece of diaper measuring about 5 inches by
3 inches is more convenient than a napkin, and can be
destroyed after use.   The cloth is laid across the front
part of the dorsum of the tongue, and folded round the
anterior segment of the organ so that a good firm hold
can be maintained without undue pressure and with-
out pulling.   The tongue is simply held in position ; it
must never be pulled upon, and care must be taken to
avoid pressing its under-surface against the incisor teeth.
Having warmed his mirror till the cloud of moisture

has just disappeared from its surface, and focussed his light upon the base of the patient's uvula, the examiner, holding the mirror lightly pen fashion, intro-duces it between the base of the tongue and the hard palate, keeping it midway between the two surfaces without touching either. The uvula and adjacent part
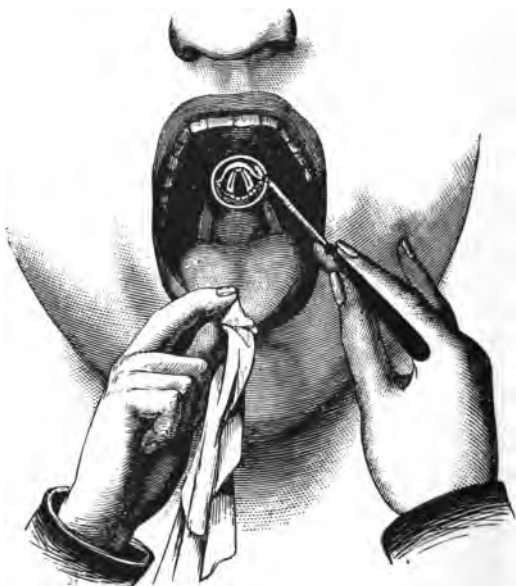
FIG. 19.—THE LARYNGEAL MIRROR IN POSITION. (AFTER STOERK.)

of the soft palate are then lifted upwards and back-wards on the back of the mirror, and its reflecting sur-face is at the same time turned downwards and for-wards. The shaft of the mirror should lie in the angle of the mouth, and the hand that holds it may be steadied by resting the tip of the extended little finger against

the patient's cheek (Fig. 19). In any further movements
of adjustment that may be necessary, the mirror itself
should be moved as little as possible. It should be held
as if fixed by its centre to the soft palate, and not touch-
ing the posterior wall of the pharynx, whilst its surface
is inclined a little this way or that by raising or lowering
the handle, or gently rotating the shaft. In ordinary
cases the student will have no great difficulty in obtain-
ing a view of the interior of the larynx—the posterior
part of it, at any rate—but he must remember that
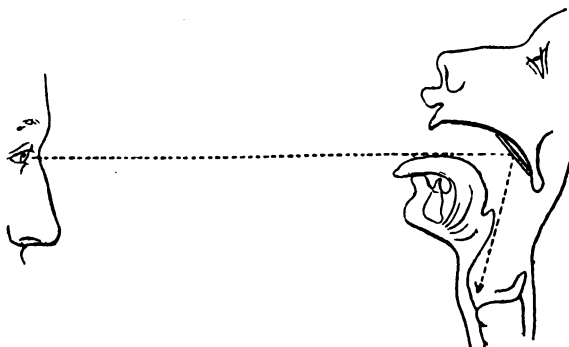
FIG. 20.—DIAGRAM OF POSITION OF LARYNGEAL MIRROR AND
COURSE OF RAYS OF LIGHT. (AFTER COLLET.)

what appears anterior in the mirror is posterior in
reality, and *vice versâ.*

As regards right and left, there is no transposition,
but as the patient sits facing the surgeon, structures on
the surgeon's right are necessarily on the patient's left,
and *vice versâ* (Fig. 21). The different parts of the
fauces vary considerably in their tolerance of contact,
but a firm touch is generally well borne. Nothing is
more irritating than a hesitating one.

The uvula and soft palate bear contact well; the

pillars of the fauces and the posterior wall of the
pharynx are decidedly more sensitive. In patients
in whom the throat is irritable, however, it is often
desirable to avoid touching even the uvula and soft
palate, and this may be managed by directing the
patient to sing the note ' A ' just as the mirror is about
to be placed in position, but before it has come into
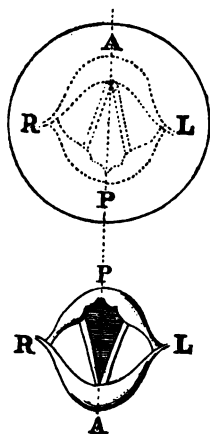
FIG. 21.—DIAGRAM TO ILLUSTRATE THE RELATION OF THE
   LARYNGEAL IMAGE, AS SEEN IN THE MIRROR, TO THE REAL
   LARYNX. (AFTER COLLET.)

A A, Anterior.   P P, Posterior.   R R, Right,   L L, Left.

The circle represents the laryngeal mirror, the dotted figure
the laryngeal image, and the lower figure the real larynx.

actual contact with the palate. Instantly with the
intonation the soft palate rises, the mirror is placed
in position, and a complete view of the larynx may
frequently be obtained without the patient even being
conscious of a touch. If next the patient be directed
to take a deep breath, and then to breathe quietly, a

fairly complete examination of the larynx during phonation, rest, and abduction will have been made. This manœuvre is not always necessary, but it is the simplest way of quickly getting a view of the larynx in many cases, and the writer very frequently adopts it in practice.

When a spirit-lamp is used to heat the mirror, the surgeon should test its temperature on the back of his hand before introducing it.

The commonest difficulties in laryngoscopy are con-nected with the shape and position of the epiglottis. It may be inclined backwards over the entrance of the larynx, or it may be doubled upon itself like the spout of a pitcher, and either condition greatly increases the difficulty of seeing the anterior part of the larynx. An inclined epiglottis may often be raised by asking the patient to sing or attempt to sing a high note. It is impossible to sing a high note such as ' E ' while the larynx is being examined, but the attempt to do it usually suffices. By sounding an aspirate before the vowel A (as in ' hay ') the epiglottis is more effectually thrown up, especially if the note be preceded by a deep inspiration. When this does not effect the object in view, the epiglottis may be cocainized and raised by a bent probe hooked over it, whilst the mirror is held in the left hand and the patient takes charge of his own tongue.

Two applications of cocain (10 to 20 per cent.) are necessary to sufficiently anæsthetize the epiglottis, and the drug must be well rubbed into the laryngeal surface at intervals of two or three minutes.

In very irritable patients a fine spray of 5 per cent. cocain may be applied to the fauces in order to facilitate laryngoscopic examination; but the spray must be a

very fine one, throwing not more than one drop for each
squeeze of the bellows, and only a few drops should be
applied.   With an expert examiner this is almost never
necessary.

In a few cases it is impossible for the tongue to be
protruded, either because of congenital malformation—
the tongue being tied down to its very tip—or from
inflammatory infiltration about its base, as in some
septic phlegmonous conditions.   In such cases, by gently
depressing the tongue, and if possible pulling it some-
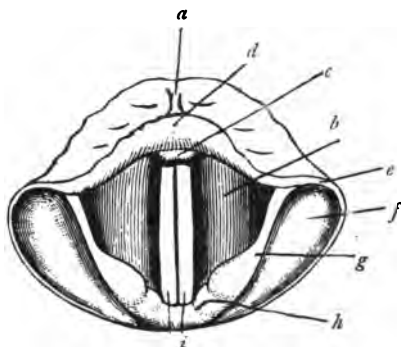
FIG. 22.—LARYNGEAL IMAGE DURING PHONATION.   (SEMI-
DIAGRAMMATIC.)

a, Median glosso-epiglottic ligament.   *b*, Epiglottis.   *c*, Cushion of Epiglottis.
d, False cord.   *e*, Pharyngo-epiglottic fold.   *f*, Sinus pyriformis.   *g*, Ary-
teno-epiglottic fold.   *h*, Arytenoid cartilage.   *i*, True vocal cords.

what forward with a spatula, the posterior part of
the larynx can generally be seen quite well.   A tongue
depressor with a hooked end which fits into the glosso-
epiglottic fossa is of advantage in such cases, and the
same procedure may be successfully practised in young
children.   Escat uses a bifid depressor which hooks
into the pyriform sinus on each side in infants.

Occasionally the tongue arches up towards the roof of the mouth, so that the mirror cannot be properly introduced. This difficulty is generally easily enough overcome by making the patient hold the tongue while the surgeon depresses the obstructing part sufficiently for his purpose.

For ordinary laryngeal work it is best to use a large-sized mirror. The writer uses one 1⅜ inches in diameter for routine work, and rarely finds it necessary to change it, except now and then to avoid touching enlarged tonsils. For children, of course, smaller sizes are required.

As the laryngeal mirror is introduced it reflects successively the base of the tongue, the lingual tonsil, and the anterior surface of the epiglottis. As the uvula and soft palate are raised and the mirror adjusted, the posterior surface of the epiglottis and interior of the larynx come into view.

As the first view of the larynx is usually obtained during phonation, the relations of parts will be first described in that position (Fig. 22).

In front (above in the mirror) is the epiglottis, behind (below in the mirror) are the arytenoid cartilages, and connecting these structures centrally on each side of the middle line are the white glistening bands of the vocal cords. Laterally, the arytenoids and epiglottis are connected by the aryepiglottic folds of mucous membrane, which curve forward on each side, completing the circle round the glottis. Inside this circle, and filling the space between the aryepiglottic folds and the vocal cords, are the ventricular bands or false cords. As seen from above, each false cord presents a somewhat triangular surface. The apex of the triangle points outwards, and its sides are curved ; but the base is straight,

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and rests apparently upon the white glistening band of
the true vocal cord, which extends to the middle line,
and forms the boundary of the glottis.   Each arytenoid
cartilage is surmounted by two little eminences, the
cartilage of Wrisberg externally, and the cartilage of
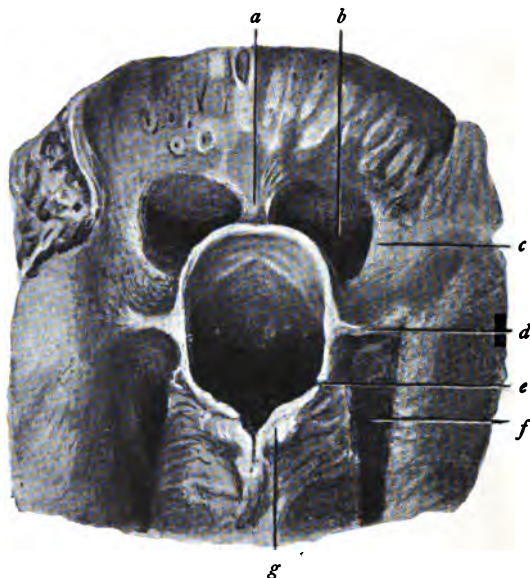
FIG. 23.—BASE OF TONGUE AND UPPER APERTURE OF NORMAL
LARYNX VIEWED FROM BEHIND. (AFTER LOGAN TURNER.)

a, Median glosso-epiglottic fold.   *b*, Right glosso-epiglottic fossa.   *c*, Lateral
glosso-epiglottic fold.   *d*, Pharyngo-epiglottic fold.   *e*, Aryepiglottic fold.
f, Pyriform sinus.   *g*, Arytenoid cartilage.

Santorini internally.   The latter is not visible during
phonation, when the cartilage of Wrisberg moves in-
wards to the middle line.

    The parts just described—viz., the epiglottis, aryte-
noids, and aryepiglottic folds—form a ring which sur-

rounds the entrance or vestibule of the larynx.   Outside
this ring—between it and the lateral wall of the pharynx
—is the pyriform sinus.   The head of the pear lies
anteriorly, and reaches as far forward as the pharyngo-
epiglottic fold (Figs. 22 and 24).   This pyriform sinus
is a common seat of extrinsic cancer of the larynx.

From the epiglottis to the base of the tongue stretch
three folds of mucous membrane, one central and two
lateral, called the glosso-epiglottic ligaments (Fig. 23).
Between the central and lateral ligament on each side
lies the vallecula or glosso-epiglottic fossa, and in front
of each vallecula lie the lymphoid follicles of the lin-
gual tonsil.   On each side the epiglottis is connected
with the lateral wall of the pharynx by the pharyngo-
epiglottic fold, and posteriorly, as has been already
described, the aryepiglottic folds connect it with the
arytenoid cartilages.   These folds are normally slender,
but they are favourite seats of infiltration in œdema
and tuberculosis.   During phonation the vocal cords
meet in the middle line, stretching from the arytenoid
cartilages behind to the epiglottis in front; during
quiet breathing they separate posteriorly, the arytenoid
cartilages receding from each other and leaving a
triangular gap with its apex in front at the epiglottis,
where the cords never separate.   The sides of this
triangle are formed by the cords themselves, and its
base by the interarytenoid mucous membrane, which
forms the posterior wall of the larynx.   During deep
inspiration the cords become still further separated, and
their edges concave, so that the gap between them
assumes more of a lozenge shape.   This is due to the
arytenoids being so widely abducted that their vocal
processes point outwards and forwards, and as the cords
are attached to the vocal processes and also to the

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middle line of the thyroid cartilage in front, an angle or bend is necessarily created in the outline of each cord. A little yellowish spot on the vocal cord near its posterior end sometimes marks the point where the vocal process of the arytenoid cartilage ends. The part of the glottis in front of this point is bounded by the cords, and has been distinguished as the ligamentous glottis; whilst the part behind this point lies between the arytenoids, and so has been called the cartilaginous glottis. The
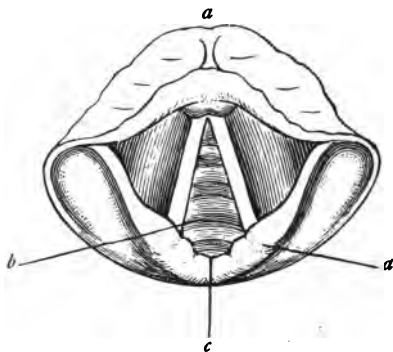
FIG. 24.—LARYNGEAL IMAGE DURING QUIET BREATHING. (SEMI-DIAGRAMMATIC.)

a, Base of tongue.   *b*, Trachea.   *c*, Interarytenoid mucous membrane.
d, Arytenoid cartilage.

point where the cords meet in front in the angle of the thyroid cartilage is called the anterior commissure ; the posterior or interarytenoid commissure lies midway in the posterior wall. Immediately above the anterior commissure there is often a little swelling called the cushion of the epiglottis. Between the true and the false vocal cord is a narrow interval which leads into the ventricle of Morgagni. This is best seen when the

patient's head is slightly inclined to one side and the laryngeal mirror is moved towards the same side. Thus the head must be inclined to the left side and the mirror moved to the left of the middle line in order to display the right ventricular opening.

The anterior commissure is the most difficult part of the larynx to see ; the surgeon should sit higher than the patient when he wishes to reach it. The posterior wall of the larynx is best seen when the examiner is placed lower than the patient. The examiner may sit on a high stool whilst the patient stands and bends his head slightly forward, or the examiner may kneel in front of the patient, who sits in the ordinary chair. The latter is the best position for examining the trachea and the bifurcation of the bronchi.

The interarytenoid mucous membrane sometimes shows a slight tendency to vertical wrinkling, which becomes more marked as the cords approach each other.

The larynx should be examined during phonation, when the cords ought to be parallel and almost touching ; during quiet breathing, when they ought to lie midway between adduction and abduction ; and during deep inspiration, when the limit of abduction is reached.

The movements of the two sides of the larynx ought to be equal and symmetrical, and the glottis should lie in the mesial plane. Occasionally one arytenoid cartilage is seen to cross slightly in front of the other during phonation, and this may occur—presumably as a congenital condition—in a perfectly healthy larynx. A much rarer congenital condition is obliquity of the glottis—scoliosis of the larynx, as the Germans call it. As a rule, however, an oblique glottis signifies a compensated paralysis of the recurrent laryngeal nerve, or ankylosis of the crico-artyenoid joint, or some grave

infiltration interfering with movement. The normal colour of the arytenoid and interarytenoid mucous membrane and of the false cords is similar to that of the mouth ; the aryepiglottic folds are rather lighter in colour, with a yellowish hue, and this is much more marked in the epiglottis. The vocal cords are a brilliant white as a rule, but in some few persons—especially professional vocalists—a pinkish tinge seems to be normal.

THE COMMONER MORBID ALTERATIONS IN THE LARYNGOSCOPIC IMAGE

ONE of the most frequent changes is hyperæmia. This may be bright red and diffuse, as in some acute catarrhs, but the change is most noticeable on the cords, contrasting with their normal whiteness. Very often, however, especially in chronic cases, the hyper-æmia is much more marked in some parts than in others. The ventricular bands may be chiefly affected, overlapping the vocal cords and perhaps completely concealing them, or the posterior wall may bear the brunt of the process, its natural tendency to vertical folding being increased by the swelling, so that perfect adduction of the cords becomes difficult or impossible. Catarrhal signs limited to the posterior parts of the larynx—posterior wall, arytenoids, vocal processes—are suggestive of pulmonary tuberculosis, especially if the larynx be otherwise anæmic. The vocal processes in these cases look as if they had been scratched with a needle, the cords do not come well together, and threads of secretion stretch across between them. Pronounced anæmia of the larynx is always suggestive of phthisis, especially when the laryngeal anæmia seems to be more marked than the general anæmia.

In chronic laryngitis the cords are often of a

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reddish-gray colour, their fine smooth edge is gone, their surface is dull and slightly uneven from epithelial changes, and their movements are often imperfect from inflammatory paresis of their muscles. The internal thyro-arytenoid or internal tensor muscles are most frequently affected in this way, owing to the fact that they lie just beneath the mucous membrane of the cords, and are closely incorporated with their substance. The sign of their paresis is an elliptical gap between the cords during phonation.

Redness of the cords is generally symmetrical when it is due to catarrh ; redness of one cord should—in the absence of injury—be regarded with suspicion as suggest-ing a constitutional cause such as tuberculosis, syphilis, or cancer.

Hyperplastic changes are common in chronic laryn-gitis, and are well seen in some confirmed topers, espe-cially such as smoke heavily. The interarytenoid mucous membrane is often considerably thickened, and projects between the cords, making perfect adduction impossible. A still more marked swelling in this region is the interarytenoid tumour of phthisis, but that is a tubercular infiltration, not a simple hyperplasia. The false cords are often swollen so that they overlap or entirely conceal the vocal cords, and the mucous mem-brane lining the ventricle of Morgagni sometimes undergoes hypertrophy and projects over the vocal cord as a dark-red swelling, entirely concealing its anterior part—the so-called ' prolapse of the ventricle.'

The most serious form of hyperplasia, however, occurs below the glottis. In acute subglottic laryn-gitis the inflamed mucous membrane is sometimes seen projecting beyond the edges of the vocal cords like a broad red hem. The writer has seen this very typically

in influenza. The stridulous laryngitis of children is
frequently, if not always, a subglottic affection. Chronic
subglottic laryngitis leads to marked hypertrophy, a
broad cushion of fibrous tissue projecting beyond the
cord, and giving rise to severe dyspnœa with every
attack of cold. It must be distinguished from sclero-
matous infiltration, which occurs in the same region, and
presents a similar appearance.

Epithelial thickening — pachydermia—is not un-
common in chronic laryngitis. Of this nature are
' singers' nodules,' which form on the edges of the cords
at the junction of their anterior and middle thirds, as
the result, probably, of attrition from faulty voice-
production. The vocal processes are also liable to a
similar formation, a nodule forming on each process ;
but the voice may continue fairly good, because during
phonation the one nodule slips in front of the other, and
the cords are fully adducted. After a time there is
upon each cord a nodule and an indentation, and
during phonation these fit into each other like the teeth
of two cogged wheels. The posterior wall is also a
common seat of pachydermia, which causes it to assume
a dirty grayish colour, and accentuates the natural
tendency to wrinkling. There is often a deep fold at
the posterior commissure.

In the larynx, as elsewhere, the principal thing is
not so much the diagnosis of the exact pathological
condition present, as the recognition of the cause, or
causes, which have produced and are maintaining that
condition. In this regard the student will do well to
bear in mind the frequency with which laryngeal in-
flammations, and especially chronic inflammations, are
secondary to some other condition.

Thus, mouth-breathing is a very frequent contributory

cause both in acute and chronic cases of laryngitis. The
healthy nose warms and filters the inspired air and
saturates it with watery vapour, and the interruption
of this function, whether the interruption be complete
or only nocturnal (as in many cases of turbinal conges-
tion), exerts an influence the reverse of favourable
upon an inflamed larynx.

The dripping of pus from the naso-pharynx into the
larynx is another fairly common cause of chronic
laryngitis. In children the source of the pus is almost
always adenoid growths ; this is so constantly the case
that chronic hoarseness in a child should always suggest
the presence of adenoids even if none of the other usual
symptoms, such as snoring, deafness, and frequent
head colds, be present. To make quite sure the larynx
must be inspected, in order to demonstrate the absence
of papillomata. In adults the drip generally comes
from the posterior nasal sinuses, and it is responsible
for a good many cases of chronic laryngitis, generally
of the hyperplastic type, and including some cases of
pachydermia. The infection of the larynx in phthisis
by the passage of tuberculous pus upwards from the
lungs is another familiar example of secondary laryngitis.

Atrophic changes in the larynx are always secondary
to very chronic nasal suppuration or 'ozæna,' in which pus
has dripped into the larynx and there formed adherent
crusts. The wasting is much less obvious in the larynx
than in the nose, but the method of its production is
similar. As long as the pus remains liquid it causes no
atrophy, but rather, as we have seen, a hyperplastic
condition ; it is only when the pus forms crusts which
adhere to the mucous membrane and press upon it that
atrophic changes set in. The wasting is probably partly
due to the pressure, and partly to the interference with

nutrition which close continuous contact with putrid
crusts must of necessity produce in a delicate mucous
membrane. The crusts sometimes give rise to severe
suffocative attacks, and are dislodged with difficulty.
They are formed chiefly in the night during sleep, the
pus dripping into the larynx and drying in the air-stream.
In other cases thick liquid pus may be seen coating the
trachea. Such patients have a morning cough, with a
heavy purulent spit—' nummular,' perhaps—and as
they are often thin and pallid, with bad general health,
the suspicion of phthisis is not rarely entertained, and
sometimes even a positive diagnosis is ventured to this
effect. The fact that there is old nasal trouble in these
cases is sometimes concealed from a mistaken sense of
shame ; the symptoms that drive the patient to the
doctor are throat and chest symptoms, and some would
probably never seek relief if they knew that the whole
thing was due to the old nasal suppuration, which they
may very probably have learned to regard as an evil to
be endured—and kept as quiet as possible ! Stringy
mucus is frequently seen in chronic laryngitis, lying on
the cords in little masses, or stretching between them in
threads as they recede from each other in abduction.

Swelling of various parts of the larynx is common.
The posterior wall, the false cords, and the subglottic
mucosa have been already referred to in this relation.
Acute swelling can only be due to œdema, and it affects
especially the aryepiglottic folds, which appear as pale
or livid tense swellings immediately behind the epi-
glottis.

The anterior surface of the epiglottis also swells freely
when inflamed, as it is sometimes from the swallowing
of scalding or corrosive liquids. Chronic swelling and
œdema most frequently affects the arytenoid cartilages

and aryepiglottic folds, and the epiglottis. Marked
swelling of a cartilage indicates perichrondritis, of which
tubercle and syphilis are the most probable causes.
The cricoid and thyroid cartilages are less frequently
affected and also less easily seen. Gummatous swellings
are not very uncommon in the trachea, and their timely
recognition is of enormous importance.

Ulceration is common in the larynx. Superficial
loss of substance occurs in chronic catarrh and pachy-
dermia, but in neither case does the destruction ever
extend beyond the superficial layer of the mucosa.
Deeper ulceration may be due to tuberculosis, syphilis,
or cancer.

Tubercular ulceration affects first and chiefly the
arytenoid region and the vocal cords. The epiglottis
is often affected, but only in the later stages of the
disease, when the diagnosis is evident. The mucous
membrane surrounding a tubercular ulcer is pale.

Syphilitic ulceration shows a preference for the epi-
glottis and false cords. The epiglottis is often attacked
first, and a large piece may be rapidly eaten out of its
margin. When two ulcers are present they are symme-
trical, but if only one be present it rarely crosses the
middle line, but rather spreads along the ary-epiglottic
fold to the arytenoid. A syphilitic ulcer is generally
surrounded by a zone of hyperæmia.

The posterior wall is very rarely affected in syphilis,
whilst it is the favourite seat of tubercular ulceration.

A serrated edge on the vocal cords indicates tuber-
culosis, not in the first stage. The cords present an
irregular edge in some cases of secondary laryngitis from
nasal suppuration, but the other appearances are not
those of tuberculosis, and there will be pus or crusts in
the nose.

Cancer of the larynx is most liable to be confounded with syphilis. Large doses of iodides should be given for a fortnight in any case where there is doubt.

Persistent hoarseness in an elderly patient (generally a man) is a very suspicious symptom, suggestive of incipient malignant disease.

Localized thickening of one cord, with some redness and impaired mobility, points strongly to malignant disease, and it must be remembered that the view in the mirror never gives an adequate idea of the real extent of malignant infiltration in such a case.

Benign growths in the larynx have a strong predilection for the vocal cords, and especially for their free border. Soft fibromata, generally of small size and more or less pedunculated, grow only in this situation.

Cysts and papillomata are the only two other forms of benign growth which occur with any frequency in the larynx. Papillomata are generally multiple—always so in children—and tend to recur with great persistence in young patients. In adults this tendency is much less marked.

Alterations in the Movements of the Cords. —By far the most frequent change is that already described as caused by paresis of the internal tensors of the cords (the internal thyro-arytenoid muscles), due in acute cases to the direct extension of inflammation from the cord to the muscle. Vocal strain produces the same effect, and the two causes often act together. There is an elliptical gap between the cords during phonation.

The (transverse) arytenoid muscle is also somewhat liable in severe cases of catarrh to this inflammatory paresis, which shows itself by the appearance of a

triangular gap at the posterior part of the glottis. The cartilaginous glottis, in fact, remains open.

In acute laryngitis with complete aphonia these two forms of paresis may be found combined, and the appearance of a double glottis is thus produced—an elliptical gap in front (glottis ligamentosa) and a triangular gap behind (glottis cartilaginea), and between the two the vocal processes touching, drawn together by the lateral thyro-arytenoid muscles. This combination is also not infrequently found in hysteria.

Paralyses of Nerves.—The superior laryngeal nerve
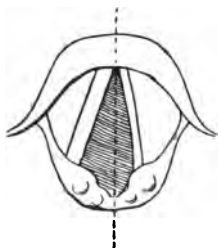
FIG. 25.—PARALYSIS OF LEFT RECURRENT DURING QUIET BREATHING. (AFTER COLLET.)
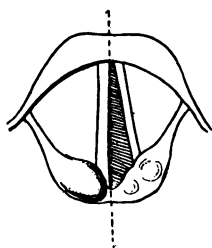
FIG. 26.—PARALYSIS OF LEFT RECURRENT DURING PHONATION. (AFTER COLLET.)

supplies the mucous membrane of the larynx and the crico-thyroid muscle, which is the external, and chief, tensor of the cords. When this nerve is paralyzed the larynx becomes anæsthetic, and the cords remain lax during phonation. The line of the glottis is wavy or sinuous instead of straight, and high notes cannot be produced.

By far the most important laryngeal paralysis, however, is that of the recurrent nerve, which supplies all the muscles of the larynx except the crico-thyroid. Its possible causes are numerous, and may be best

understood by studying the course of the nerve ; but cancer of the œsophagus and aneurism of the aorta are the diseases one should think of first. In cancer the onset of symptoms is very slow and gradual, and the larynx is often enough affected before there is any dysphagia. In aneurism the onset is less gradual, and the symptoms vary more. Goitre, pulmonary tuberculosis, and enlarged glands are the next most frequent causes. From its long and exposed course the left recurrent is naturally the more liable to paralysis.

The paralysis is a true hemiplegia of the larynx. The affected cord rests immovable midway between adduction and abduction. Its free margin is concave instead of straight. It is narrower than its fellow, and it lies at a lower level than the sound cord.

In old cases the paralysis is compensated by the sound cord crossing the middle line to meet the paralyzed one, and the glottis thus becomes oblique. In recent cases the affected cord sometimes lies in the mesial plane, and this is supposed to indicate irritation of the nerve fibres supplying the adductor muscles—an irritation preceding complete paralysis.

Bilateral paralysis of the abductors occurs in Tabes, and may require the performance of tracheotomy. It is sometimes an early sign, and may indeed be the only one present (Semon's case).

The ' laryngeal crisis ' of tabes begins with a feeling of intense irritation in the throat or larynx. This sets up violent paroxysmal cough, and the attack ends generally with a deep inspiration or ' whoop,' not unlike that of pertussis. These two last-named complications sometimes occur in the same patient, and the crises are undoubtedly aggravated by the abductor paralysis ; indeed, it is maintained by some that they are entirely due to it.

THE EXAMINATION OF THE EAR

FOR the examination of aural cases the following instruments are required :

1. A set of four aural specula (Gruber's or a similar make) with an elliptical section.

2. A fine probe of silver ; the same one answers for the nose and pharynx.

3. A pair of Wylde's aural forceps, which are still the best in spite of many modifications.

4. A blunt hoe or scoop for removing soft wax, scales, etc., from the meatus during examination.

5. Two short Eustachian catheters of silver. If the beak of one be given a curve of 16 millimetres from the line of the shaft, and that of the other a curve of 18 millimetres, they will seldom require alteration.

6. A Politzer's bag with a soft rubber nozzle, which can be taken off and replaced by a conical vulcanite nozzle to fit the trumpet-shaped end of the Eustachian catheter. The bag should have a refill valve at the base.

7. An auscultation tube.

8. A Siegel's suction speculum, with three ends, covered with rubber tubing.

9. A tuning-fork. Gardiner-Brown's is a convenient pattern, and the middle C (256 vibrations per second) is a suitable pitch.

10. A syringe. A glass one, holding from $1\frac{1}{2}$ to 2 ounces, with a rubber plunger, can be bought for about a shilling, and answers quite well for ordinary purposes.

11. A Galton's whistle is very useful for testing the power of hearing high notes in cases of suspected nerve-deafness, but it is rather a luxury than a necessity for the practitioner.

The usual tests of hearing-power are the watch, the tuning-fork, whispered speech, and ordinary conversational speech.

An English lever watch can be heard by a normal ear at 60 inches distance. This 60 inches is made the denominator of a fraction, of which the numerator is the patient's hearing-power for the watch as expressed in inches. Thus, if a patient can hear the watch at 15 inches with his right ear, the result is expressed thus : Watch R $\frac{15}{60}$.

The watch should first be held at a distance, out of range of the ear in fact, and then gradually brought nearer till the patient can hear it, when the distance in inches is noted, and put down as the numerator of the fraction.

Hearing-power for whispered, conversational, and loud speech is tested in the same way, the examiner beginning at a distance, and coming gradually nearer till the patient hears.

The two most useful tuning-fork tests are Weber's and Rinne's.

Weber's Test.—A vibrating tuning-fork placed on the vertex is normally heard ' all over ' by bone-conduction. If one ear be stopped it is better heard in that ear. Now, obstructive disease of the meatus or tympanum acts in the same way as stopping the ear,

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as far as the tuning-fork is concerned, so that in uni-
lateral obstructive disease of the external or middle
ear the tuning-fork is better heard in the deaf ear.   In
disease of the conducting part of the auditory apparatus
(meatus and tympanum) bone-conduction is generally
prolonged ; in disease of the receiving apparatus (audi-
tory nerve and labyrinth) bone-conduction is generally
shortened.

Rinne's Test.—A vibrating tuning-fork placed on
the mastoid process is heard by bone-conduction.   If,
as soon as it ceases to be audible, it be removed from
the mastoid and held just opposite the opening of the
external meatus, its vibrations will again become audible
(by air-conduction, of course), and will continue so for
a good many seconds.   This is the normal reaction, and
Rinne's test is said to be positive, written thus : Rinne + .

In disease of the middle ear, bone-conduction is very
generally prolonged, while air-conduction is shortened,
and thus the period of air-conduction is, as it were,
shortened at both ends.   In slight cases Rinne's test
still remains positive, the fork continuing to be heard
for a few seconds after it has been transferred from the
mastoid to the meatus, but in more marked cases
Rinne's test becomes negative (Rinne −)—*i.e.*, the fork
is no longer audible at the meatus when it ceases to be
heard on the mastoid.   In other words, bone-conduc-
tion outlasts air-conduction.   This is the rule in cases
of pronounced middle-ear disease.   In nerve-deafness,
on the other hand, bone-conduction is shortened, and
although air-conduction is also shortened Rinne's test
remains positive.

Other signs of nerve-deafness are inability to hear
high-pitched notes, worse hearing in a noise, and bad
hearing for the watch as compared with the voice.   A

fairly common and often unsuspected cause of nerve-
deafness is the abuse of tobacco. Hysteria is also not
rarely a factor.

In middle-ear deafness, as has long been known, many
patients hear better in a noise, and their hearing for the
watch is relatively much better than for conversation.

·When both the patient's ears are affected, the surgeon
may (if his hearing be perfect) use his own ears as a
normal stándard in comparing the length of bone-
conduction on vertex or mastoid.

When bone-conduction seems to be prolonged, the
surgeon applies the vibrating tuning-fork to his own
mastoid or vertex, and the instant he ceases to hear
it, transfers it to the patient's, and notes the number
of seconds during which he (or she) continues to hear
it. When bone-conduction seems to be shortened the
procedure is reversed, the fork being first applied to
the patient's mastoid and then transferred to the
surgeon's. Bone-conduction, it must be remembered,
diminishes as age advances.

In examining cases of ear disease it is always desirable
to know the condition of the Eustachian tube, and this
is ascertained, in the absence of any contra-indication, by
inflating the tube and tympanum, either by Politzer's
method or through the Eustachian catheter. Contra-
indications to inflation are : (1) Acute inflammatory
conditions of the naso-pharynx or tympanum ; (2) the
presence of infective material (blood, pus, or mucus) in
the nose or naso-pharynx ; (3) recent injury to the
middle ear or labyrinth.

To inflate the Tympanum with Politzer's Bag.—
Introduce the soft rubber nozzle into one nostril, and
compress the ala firmly round it, whilst the other nostril
is closed by the thumb or fore-finger. Then tell the

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patient to puff out his cheeks, keeping the mouth closed, and when he does so compress the bag vigorously. The patient should feel the air 'go to the ears'; if not, the inflation has probably failed, and it will be necessary to try again. Next time direct the patient to take a little water into his mouth, and keep it there till he is told to swallow; then adjust the bag as before, say to the patient, 'Swallow,' and compress the bag while he is in the act of swallowing—*i.e.*, as the larynx rises. If neither of the above methods succeed it will be necessary to pass the Eustachian catheter.

To pass the Eustachian Catheter.—Having connected his ear with the patient's by means of an auscultation tube, and examined the catheter to see that it is clean and pervious, the surgeon inspects the nostril carefully through a Thudichum's speculum, and sprays a few drops of a weak solution of cocain (5 per cent.) and adrenalin chloride (1 in 10,000) into it. After waiting for a minute or two to allow the cocain to take effect, the nasal speculum is introduced again, and the catheter passed horizontally backward along the floor of the nose till its point is felt to impinge against the posterior wall of the pharynx. The catheter should be held very lightly, with the ring (and the beak) pointing downwards, and passed quickly through the nostril. The catheter being now fairly through the nostril and resting on the floor of the nose, the speculum may be removed.

To find the Opening of the Eustachian Tube.—Withdraw the catheter slightly, so that its point no longer touches the posterior wall of the pharynx, and rotate it through a quarter of a circle till the ring which was pointing vertically downwards points transversely towards the opposite nostril. The point of the catheter

is thus rotated away from the tube it is desired to reach.
Next, withdraw the catheter till the hollow of its curve
is felt to catch against the sharp posterior edge of the
septum. Finally, rotate the instrument downwards and
then upwards through half a circle, or rather more, till
the ring points horizontally or slightly upwards. The
point will then be felt to be engaged under the project-
ing cartilage of the tube, and may be fully introduced
with a gentle rotatory movement.

If the catheter turn quite round instead of catching
on the cartilage of the tube, it shows that the beak of
the instrument is insufficiently curved, and a catheter
with a larger curve will be required.

Difficulty in the introduction of the catheter may be
due to swellings or enlargements about the back of the
nose, to tortuosity of the nostril, which may be so
marked that the catheter cannot be passed through it
without undue force, or to some anterior obstruction, as
when a septal ridge is pressed against the lower turbinal
so that the two together form a low arch, beneath which
the curved catheter cannot pass with its concavity
downwards. It will sometimes pass readily enough,
however, with its concavity upwards till the obstruction
is passed, and it can then be manœuvred through the
lower meatus. Sometimes the point may be slid along
the floor of the nose under cover of the lower turbinal.

In other cases the catheter may be first passed above
the obstructing arch, and then pressed down between
septum and turbinal till it reaches the floor of the nose.
The manœuvre suitable to each individual case will
readily suggest itself to anyone who is familiar with
nasal topography and who can see well into the nostril.
By giving the catheter an extra large curve it may often
be successfully passed from the opposite nostril, the

surgeon bearing in mind the fact that the tubal opening is about half an inch distant from the posterior pharyngeal wall. The practised manipulator rarely goes through the steps described above in introducing the catheter, but it is well for the student to begin with a definite method and fixed guides.

Having been successfully introduced, the catheter must be held firmly in position and steadied against the tip of the nose so as to prevent the point from moving during subsequent manipulations. The nozzle of the Politzer's bag is then inserted in the catheter, and the bag compressed several times in succession.

The character of the various sounds heard through the auscultation tube can only be appreciated by practice, but when the sounds are faint and distant, a better result may often be obtained by inflating during the act of swallowing, or by some very trifling change in the position of the point of the instrument. The surgeon ought always to hear the sound of the inflation if the tube is free and the catheter properly placed. The patient usually feels distinctly how it goes, but in some cases the tube and tympanum seem to be anæsthetic, for nothing is felt, although the surgeon's ear informs him that an adequate inflation has taken place. A few drops of water in the auscultation tube will effectually prevent the surgeon from hearing the sounds.   .

Siegel's suction speculum consists essentially of an aural speculum closed by glass at the wider end, and connected at the side by tubing with a rubber ball. When the speculum is fitted air-tight into the meatus the drumhead can be inspected through the glass window, and by compressing and relaxing the rubber ball the membrane can be alternately driven in and sucked out, according as the air in the meatus is com-

pressed or rarefied. It is sometimes difficult to fit the speculum accurately to the meatus in a position which will give a good view of the drumhead. This is facilitated by covering the end of the speculum with rubber tubing, or by wrapping a layer of wool round it.

The instrument is useful for ascertaining the mobility of the membrane and the malleus, and for increasing that mobility by alternate compression and relaxation (so-called ' massage '). It may also be used to suck out discharge through a small perforation, if for any reason incision be impracticable.

In examining the ear the student should first notice the condition of the auricle and the parts around it—the periauricular or periotic region. The most frequent disease of the auricle is eczema, which presents the usual characters, and often involves the external meatus, even in cases in which there is no irritating discharge from the middle ear. Herpes, lupus, and syphilis also affect the auricle, but much more rarely than eczema.

Hæmatoma occurring in persons otherwise healthy is generally traumatic (football, boxing) ; spontaneous hæmatoma is associated with some forms of insanity. Perichondritis is rare, and is generally due to injury and septic infection.

In the periauricular region the parotid, mastoid, and occipital lymphatic glands will often be found enlarged, usually from the absorption of inflammatory products, which must be traced to their source in the ear, scalp, or elsewhere.

Mastoid swelling is most evident in cases of periostitis and abscess ; the auricle stands out from the head, and after a time there is fluctuation. Inflammation and abscess confined within the mastoid cause much more severe general symptoms—fever, pain, tenderness on

percussion—although local signs, such as swelling and fluctuation, may be at first entirely absent.

Tenderness at the tip of the mastoid, with swelling extending downwards into the neck along the sterno-mastoid muscle, usually indicates that a mastoid abscess has perforated the apex of the process, and is burrowing under the deep fascia—' Bezold's ' mastoiditis. Marked tenderness at the tip of the mastoid suggests the possible onset of this condition.

A mastoid sinus, the result of an old abscess, will generally be found associated with considerable disease of bone, involving the antrum and middle ear; and con-sequently the simple opening and scraping of such a sinus is, as a rule, perfectly futile.

Having examined the periotic region, the student should next inspect the opening of the meatus without using a speculum. This is done by holding the tragus forward with the tip of the thumb or finger of one hand, while the auricle is pulled upwards and back-wards with the thumb and forefinger of the other hand. The meatus, it must be remembered, is a curved passage running forwards and inwards, of which the floor and anterior wall present a more or less marked convexity; by pulling the auricle upwards and back-wards the curve of the passage is partly straightened out, so that it is possible in some cases to obtain a fair view of the drumhead without the use of a speculum, and in any case the outer part of the meatus is brought into view by this manœuvre, and any painful swelling such as a furuncle, which would interfere with the use of a speculum, will become evident. There is often no noticeable redness about furuncles in this situation, even when pain and disturbance are considerable; and the student will therefore do well when he is in doubt to
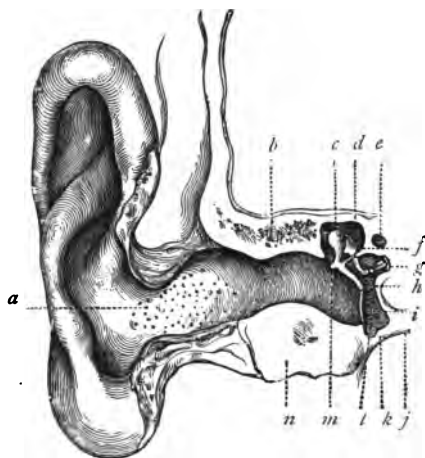
Fig. 27.—Vertical Transverse Section of Ear, showing
Meatus, Tympanum, and Attic, with Ossicles in Position.
(After Politzer.)

a, Glands.   *b*, Air-cells.   *c*, Head of malleus.   *d*, Roof of attic. *e*, Facial
canal.   *f*, Body of incus.   *g*, Stapes.   *h*, Handle of malleus.   *i*, Mem-
brana tympani.   *j*, Jugular fossa.   *k*, Floor of tympanum.   *l*, Tympanic
cavity.   *m*, Short process.   *n*, Lower wall of meatus.

Note: 1.—The curve of the meatus and the narrowing of the
bony part.

2.—The very open angle at which the roof of the meatus
joins the membrane, and the sharp angle below where floor of
meatus and membrane meet.

3.—The 'attic' or upper chamber of the tympanum extending
above the level of the meatus, containing the bulk of the ossicles,
and shut in externally by the overhanging part of the roof of
the bony meatus, the so-called 'outer wall of the attic' which
is removed in the radical operation.

4.—The presence of air-cells in the roof of the meatus.

5.—The section also shows the head (*c*), short process (*m*), and
handle (*h*) of the malleus in section, and the membrana tympani
(*i*) extending from the end of the handle to the lower wall of the
meatus.

test for tenderness by gentle pressure with a probe. Simple inspection will also often reveal the fact that the meatus contains pus, which will have to be mopped or washed away before it is possible to proceed further with the examination. It may seem superfluous to insist upon anything so obvious as this, but practical experience has shown the writer that much of the difficulty experienced by beginners in examining the ear is due to the fact that the meatus is not clear, the view being
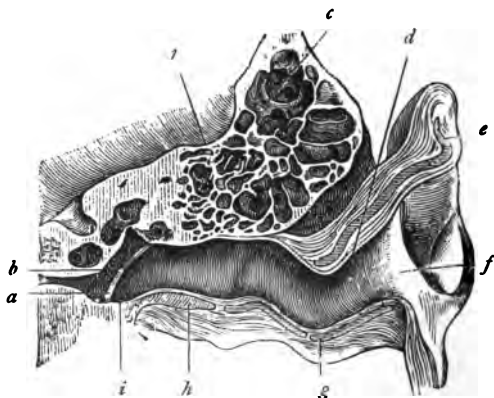
FIG. 28.—HORIZONTAL SECTION OF EXTERNAL MEATUS, TYMPANUM, AND MASTOID PROCESS. (AFTER POLITZER.)

a Membrana tympani.   *b*, Cavity of tympanum.   *c*, Mastoid cells.   *d*, Concha. *e*, Cartilage of auricle.   *f*, External meatus.   *g*, Tragus.   *h*, Anterior bony wall.   *i*, Sinus or recess of meatus.   *j*, Sinus groove.

NOTE: 1.—The zigzag curves of the meatus—forwards, backwards, and again forwards.

2.—The very open angle (or, rather, curve) which unites the posterior wall of the meatus with the membrana tympani.

3.—The sharp angle or recess formed by the junction of the anterior wall and membrane.

4.—The relation of the mastoid process and cells to the posterior wall of the meatus and to the sinus groove.

obstructed by various obstacles, the nature of which
may not at first be evident to the student—nor even the
fact that they are obstacles—and which must be re-
moved before it is possible to obtain a satisfactory view
through a speculum.

The simple forms of aural specula are the best. The
writer prefers those with an oval or elliptical section
such as Gruber's, but other forms (Politzer's), in which
the section is circular, answer quite well. Occasionally,
when the meatus is slit-like, as in many old persons, a
speculum which is compressed laterally is easier of in-
troduction. Expanding specula, such as Kramer's,
offer no advantage, and those which present a magnified
image (Brunton's), though useful occasionally, are not
suitable for routine work. In fact, with the best illu-
mination they are not necessary even for diagnosis.
Having selected a speculum of suitable size, the auricle
is pulled upwards and backwards so as to straighten out
the meatus, and the speculum is carefully introduced
with the long diameter of the oval placed vertically,
while a bright light is reflected down the passage in order
that the examiner may see exactly what he is doing.
When introduced carelessly, the sharp edge of the
speculum may very easily excoriate the convex bulging
portion of the anterior or lower wall. Such an accident
hurts the patient, shakes his confidence in the surgeon,
and may give rise to further trouble by opening the door
to septic infection.

In cases where the meatus is strongly curved, and the
anterior and inferior walls markedly convex, consider-
able difficulty may be experienced in seeing round the
bend : and occasionally, owing to this curvature, it is
impossible to get a view of the anterior and lower part
of the membrana tympani, and a small foreign body,

such as a bead or a shot pellet, may remain concealed from view in the little recess between the floor of the meatus and the membrane.

Soft cerumen frequently interferes with the view without in any way affecting the hearing. It is generally of a light yellowish-brown colour, and sometimes has a reddish tinge, which may cause a beginner to mistake it for granulation tissue. When a speculum is introduced, soft wax is apt to be pushed up in front of it, effectually shutting off all view of the deeper parts. A small blunt scoop or hoe is the most convenient instrument with which to remove soft wax, and failing this, a few syringefuls of warm water will wash it out.

Considerable care is necessary in using the hoe for the removal of wax, especially from the anterior or lower wall of the meatus, as the convexity of those parts is apt to convey a false impression as to the amount of cerumen, making a thin layer look like a tolerably thick mass, and leading the examiner to press unduly upon the sensitive wall, causing the patient unnecessary pain, and very likely producing an excoriation. Should such a breach of surface occur, it is well to cover it at once with a little glycerine of carbolic acid.

Impacted cerumen is usually dark brown or almost black in colour, and of firm consistence, requiring to be softened by the use of alkaline drops or peroxide of hydrogen before it can be easily syringed out. Epidermal scales or flakes form another common obstacle, either alone or mixed with cerumen, dried exudation, etc. The blunt hoe or syringe will suffice for their removal.

An excessive growth of hair is sometimes seen in the outer part of the meatus, and this mixed with cerumen and epidermal débris may form a dense mass almost

like felt, completely blocking the passage and causing marked deafness.

A laminated epidermal plug (*keratosis obturans*) is also met with occasionally, consisting of desquamated cells arranged in layers concentrically. As a rule, in-effectual attempts have been made to remove it by syringing, and its nature may be recognised by the detachment of sodden scales from the main mass.

Foreign bodies of the most various kinds are met with in the meatus, and are not always easily recognised, especially if injudicious attempts at extraction have caused irritation and swelling of the parts. Even in cases where this has not been done there may be diffi-culty in making an exact diagnosis. Sometimes the meatus is very small, admitting, perhaps, only a No. 1 speculum, and the foreign body may have been pushed in close to the drumhead, where it lies impacted and quite unrecognisable. The writer recalls one case of this kind in which a so-called ' artificial drum ' of soft rubber was firmly wedged in this position, and only got rid of after a good deal of trouble and an attack of otitis. In no case should a foreign body be declared to be absent till the observer has had a complete view of the whole meatus and outer wall of the tympanum. The most formidable-looking foreign bodies may prove quite harmless. The writer recently removed a good-sized iron rivet, rusty and sharp, from the ear of a patient, where it had lain for three years, out of sight round the bend of the meatus, fixed in position by cerumen, and causing practically no irritation.

Having removed any obstruction from the meatus, the student will obtain a view of the deeper part of that passage and of the drum membrane, or what is left of it. Inflammation of the deeper part of the meatus is really

a periostitis, and is accompanied by marked redness, but often there is little or no swelling. In this it contrasts with inflammation of the outer part of the meatus, which, as we have seen, is generally furuncular, and is accompanied by marked swelling, but little redness.

A pale, hard swelling of the deeper part of the meatus, encroaching on its lumen or almost filling it, is probably an exostosis ; a gentle use of the probe will be necessary to complete the diagnosis. The importance of cleaning the ear has been alluded to. The simplest way of doing this is to inject a few syringefuls of warm water, and so wash out anything that obstructs the view. In doing this the auricle should be pulled upwards and backwards, and the point of the syringe should be directed obliquely against the upper wall of the meatus. It is generally best to inject along the upper wall, but sometimes it may be found easier to get beyond the obstruction by varying the direction of the stream, and syringing along, say, the posterior wall. The anterior and inferior walls, owing to their convexity, offer less likely routes. A little careful manipulation with a blunt hoe will often expedite matters by opening a channel for the water between the plug of wax and the wall of the meatus. The object is, of course, to get past the obstruction so that the return current may dislodge and wash it out. Having cleared the meatus, the parts should be dried by introducing a loosely-rolled pledget of absorbent wool with a pair of Wylde's forceps, and pushing it gently onwards till it reaches the inner end of the passage. When a discharge is slight this may suffice to clean the parts without previous syringing. The effect of these manipulations, however gently conducted, is to produce a certain amount of hyperæmia, for which allowance must be made in forming a diagnosis.

The structures which the student sees on looking
through an aural speculum when the meatus is clear
consist, normally, of the outer surface of the membrana
tympani and the adjoining parts of the meatus. Owing
to the very oblique way in which the drumhead is placed
across the end of the meatus, the posterior wall of the
meatus passes almost insensibly into the membrane in
one continuous curve without any distinct angle of
junction between the two. When the parts are con-
gested it is quite impossible to say where the meatus
ends and the membrane begins, but even in the absence
of hyperæmia the presence of a distinct angle of junction
between the posterior wall and tympanum generally
indicates that it is the posterior part of the *inner* wall
of the tympanum one is looking at—that is to say, that
the posterior part of the membrane is destroyed.

The upper wall of the meatus also meets the drum-
head at a very open angle, and when inflamed one
continuous red surface is seen; but below and in front
the angle between the drumhead and the wall of the
meatus is sharp and well defined, forming a recess
which cannot be completely seen in cases where the
convexity of the anterior and inferior walls of the
meatus is at all marked. The view through an aural
speculum in cases of disease is frequently puzzling, but
from what has been said it is evident that it must consist
(after the meatus is clear) of the membrana tympani, or,
in cases where that membrane is destroyed, of the inner
wall of the tympanum, or, when the membrane is only
partly destroyed, as is very frequently the case, of parts
of both these structures more or less altered by disease.

This being so, it is obvious that the student should
be thoroughly familiar with the normal topography of
the parts forming both the outer and inner walls of

the tympanum, in order that he may be able to recognise certain landmarks when the parts are altered by disease. The variety of appearances seen through the speculum in cases of suppurative middle-ear disease is enormous, and there is no better test of a student's progress than the facility with which he can interpret such appearances. No one who has seen a great expert like Professor Politzer at work in his clinic is likely to forget the wonderful quickness and certainty with which he can interpret the most puzzling pictures, and sketch them in coloured chalks for the benefit of his students.

The Membrana Tympani.

The outer surface of the membrane is the only part that is ever visible during life, and it is consequently the only part with which we have any immediate concern. The obliquity of the membrane has been already alluded to. Above and behind, it passes almost insensibly into the wall of the meatus, whilst below and in front the angle of junction is sharp and well defined. Its external surface looks outwards, downwards, and forwards, and presents a shallow concavity with gently bulging convex sides. It has been aptly compared to a very shallow funnel with convex sides. Owing to its obliquity the upper and posterior parts of the membrane are nearer to the eye than the lower and anterior ; it overhangs the meatus as it were, making an angle of about 40 degrees with the horizontal. The general outline of the drumhead is irregularly oval, just as the section of the meatus is oval, and its diameter is about ⅓ inch. The most prominent landmark is the manubrium or handle of the malleus, which is seen to run from the circumference of the membrane downwards and slightly backwards

to a point a little below its centre. The manubrium is
embedded between the layers of the membrane, which
is drawn somewhat inwards to the ' umbo ' or central
hollow which corresponds with the end of the bone.
It is this depression of the handle of the malleus which
gives to the outer surface of the drumhead its shallow
funnel shape. At the upper end of the malleus handle,
close to the periphery of the membrane, the short
process of the malleus is seen sticking out like a little
peg, with the membrane tightly stretched over it and

Right.   Left.
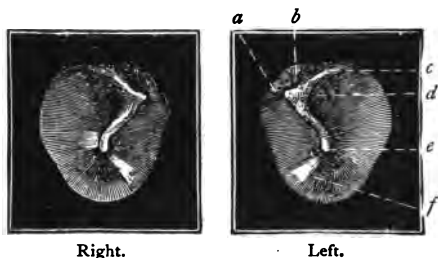
FIG. 29.—NORMAL MEMBRANA TYMPANI ; DOUBLE THE NATURAL
SIZE. (AFTER POLITZER.)

a, Anterior tympanic fold.   *b*, Schrapnell's membrane.   *c*, Posterior tympanic fold.
d, Short process.   *e*, Manubrium.   *f*, Light cone.

whitish in colour. The typical colour of the membrana
tympani in an adult is a delicate pearl gray, with a fine
smooth surface ; but this typical condition is rarely
met with in adults, and in children the normal drum-
head is more opaque and whitish. Stretching forward
and backward almost horizontally from the short
process to the periphery are two folds of mucous mem-
brane, called the anterior and posterior tympanic folds.
Above these folds is the membrana flaccida, or Schrap-
nell's membrane. This is the only part of the drum-
head which is devoid of the membrana propria, or middle

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fibrous layer of the membrane, and in this region also the bony tympanic ring or hoop to which the membrane is attached (hence the name ' drumhead ') is deficient, leaving a gap called the notch of Rivinus, which is filled by the membrana flaccida, or membrane of Schrapnell.

Although the membrana tympani is spoken of as forming the outer wall of the tympanum, yet it must be remembered that the tympanic cavity extends for a considerable distance (6 millimetres) upwards above the limit of the membrane into the cavity called the ' attic,' which contains the great bulk of the ossicles (body of the incus and malleus), and is bounded externally by the dense bone which forms the inner part of the roof of the meatus—the so-called ' outer wall of the attic ' (Fig. 27). Above, the attic is separated from the middle cranial fossa by a thin plate of bone, the tegmen tympani. In the recent state communication between the attic and the tympanum proper is not at all free, owing to the arrangement of the mucous membrane which lines the cavity, and is reflected so as to enfold the ossicles and other contents.

The floor of the tympanum lies a little below the floor of the meatus—1 or 2 millimetres.

Posteriorly, the tympanum communicates with the mastoid antrum through a passage, or ' aditus,' the floor of which is situated about the same level as the upper margin of the drumhead. The roof of the tympanum and antrum forms one continuous plate of bone.

As a rule the malleus is the only ossicle which is visible on inspecting the membrana tympani, but some- times—not very rarely—that structure becomes suffi- ciently transparent to allow of other parts being seen. The long process of the incus may then be visible, running parallel to the handle of the malleus and

somewhat posterior to it. The crura of the stapes may be seen in the same way, and even the niche leading to the finestra rotunda, and, in rare cases, the chorda tympani nerve. Running downwards and forwards from the umbo towards the circumference of the membrane is a little bright patch called the light cone or light reflex. It is normally triangular in shape, with its apex at the umbo, and is caused by the reflection of the light used in examination from that part of the membrane which is at right angles to the line of sight. Hence the position and shape of the light cone vary with the curvature of the membrane. A pulsating light cone generally indicates perforation.

It is usual for descriptive purposes to divide the membrana tympani into four regions, or quadrants, as they are called. This is best done by drawing a vertical line from the end of the malleus handle to the lower edge of the membrane, and across the upper end of this line a second is drawn at right angles to the first. This gives us four quadrants—an upper anterior and upper posterior, and a lower anterior and lower posterior.

The Inner Wall of the Tympanum.

The greater part of the inner wall of the middle ear— all its anterior and central portion—is occupied by the promontory. This is a smooth convex bony plate, which covers in the first turn of the cochlea. Above and posteriorly this smooth surface is interrupted by two openings or fenestræ, which lead into the internal ear— first, the fenestra ovalis, a kidney-shaped opening situated above and behind the promontory, and occupied in the recent state by the foot-plate of the stapes; and, second, the niche of the fenestra rotunda, a more-or less triangular opening, which looks as if it had been cut out of the

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edge of the promontory at its posterior and lower part
below and slightly behind the oval window.   Between
these two fenestræ is a smooth bridge of bone about
2 millimetres in width continuous with the promontory,
and extending backwards as far as the little bony
pyramid which contains the stapedius muscle, and
which is situated about the middle of the posterior wall
of the tympanum.

In old cases of suppuration when the membrane has
been destroyed and the parts have healed, or nearly so,

Anterior.   Posterior.

FIG. 30.—INNER WALL OF LEFT MIDDLE EAR, SHOWING THE
    PROMONTORY, THE STAPES IN POSITION, AND THE NICHE OF
    THE FENESTRA ROTUNDA. (AFTER BRÜHL.)

1 is placed on the promontory near the head of the stapes ; 2 rests on the promontory
    close to the niche of the fenestra rotunda, which in this case is small ; 3 is on
    the facial canal.   Folds of mucous membrane are seen round the stapes and
    niche.

the inner wall of the middle ear is often beautifully
seen with all the principal landmarks displayed as per-
fectly as in any anatomical preparation.   The long
process of the incus has always disappeared in these
cases, but the head of the stapes may very often be
seen with the greatest distinctness.   It appears as a little
round white body situated behind the malleus and
about the level of the short process.   It shines through
the thin transparent membrane that covers it, and is
often surrounded by bands of cicatricial tissue.   This
is an average position for the stapes, but the situation

of the fenestra ovalis varies considerably, and sometimes it is impossible to see it from the meatus owing to the overhanging bone which forms the upper and posterior wall of that passage. The niche of the fenestra rotunda lies, as we have seen, below and perhaps slightly posterior to the fenestra ovalis. The sharp outline of the clean-cut edge of the promontory which bounds and over-hangs this niche is an unmistakable landmark which the student will frequently see in old healed cases of suppuration. As long as free suppuration is taking place the mucous membrane of the promontory and other parts continues swollen and hyperæmic, and the landmarks are obscured, but as suppuration diminishes and contraction and healing take place they stand out with great distinctness. The exposed promontory in some of these cases presents a beautifully smooth polished surface of a pinkish-white or pinkish-gray colour, which reminds one very much of fine porcelain, such as that of which artificial teeth are made. The extent to which these landmarks of the inner wall can be seen through the meatus varies considerably in different cases, and depends chiefly upon the degree of concavity exhibited by its posterior bony wall. When this concavity is slight the greater part of both openings may be concealed from view. Sometimes the fenestra ovalis is situated so high up that it lies under cover of the tympanic ring, and cannot be seen even when the shape of the meatus is otherwise favourable.

What parts of the inner wall correspond to the four quadrants into which the drumhead is divided ? Fig. 31 represents the projection of the membrana tympani on the inner wall as determined by Professor Zuckerkandl.

The posterior upper quadrant contains most of the important structures—viz., the long process of the incus, the stapes lying in the fenestra ovalis, and the tendon of the stapedius running forward from the apex of the pyramid to the neck of the stapes. It also contains, as a rule, the upper and larger part of the niche of the fenestra rotunda. In this quadrant pus from the mastoid antrum first shows itself as it trickles down over the promontory into the tympanum. Thus, if after cleaning the ear pus appears at the upper and
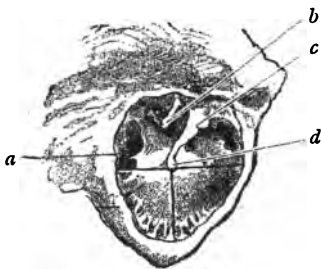
Fig. 31.—Showing the Relation of the Outer Wall of the Tympanum (Membrane and Malleus) to the Inner Wall (Promontory, Stapes and Fenestræ), and the Contents of the Various Quadrants. (After Politzer.)

a, Niche of fenestra rotunda.   *b*, Stapes.   *c*, Short process.   *d*, Manubrium of malleus.

posterior part of the inner wall and runs down as a yellow streak over the promontory, it is very probable that there is suppuration in the mastoid antrum. The student will remember that the opening into the mastoid antrum is $\frac{1}{2}$ inch above the floor of the tympanum, practically on a level with the upper edge of the membrana tympani. Pus from the attic generally oozes down in a more diffused form as a thin layer covering the inner wall.

The anterior upper quadrant corresponds with the opening of the Eustachian tube, and this opening (which is occasionally visible as a black patch) extends downwards into the anterior lower quadrant. The tubal opening is about ⅛ inch above the floor of the tympanum.

The posterior lower quadrant corresponds with the lower part of the niche of the fenestra rotunda. In some cases almost the whole of the niche seems to lie in this quadrant.

From the above description it will be evident that the posterior upper quadrant of the membrana tympani is a part to be avoided in performing paracentesis unless there be marked bulging in that situation indicating the pointing of an abscess; or intense injection with threatening mastoid symptoms which may sometimes be cut short by an incision through the upper part of the membrane, prolonged so as to divide the periosteum of the upper and posterior wall of the meatus. This, however, is not an operation to be recommended to the novice in aural surgery.

Morbid Changes.

Having considered the topography of the parts that may be seen through the aural speculum, it will be well to indicate some of the changes which the student may expect to meet with in diseased conditions. In non-suppurative ear diseases the landmarks are as a rule easily recognised, and with a little practice the student will be able to make out the changes in the drumhead. One of the most frequent changes he will meet with is retraction, in which the membrane is sunk inwards towards the inner wall. The short process of the malleus is unduly prominent, and the handle is fore-shortened and points backwards, almost parallel with

the circumference of the membrane, instead of reaching down towards its centre. The posterior tympanic fold is very prominent. This change is associated with Eustachian obstruction, and is due to the fact that the air in the tympanum is no longer renewed with its accustomed regularity; part of it is absorbed, the pressure in the middle ear is reduced, and the atmospheric pressure of the air in the meatus drives the membrane inwards.

Along with this change in curvature there will often be found changes in the membrane itself, such as opacity and thickening. A fairly uniform thickening and opacity of the membrane will be found in a large class of patients who complain of chronic progressive deafness without any history of pain or discharge. The membrane is whitish, opaque, and thickened all over. Often there is some retraction with traces of vascularity about the short process. Such are cases of chronic hyperplasia of the middle ear. The tubes are frequently thickened and obstructed, and nasal stenosis is not rarely present. In another type of case similar in many respects to the above the membrana tympani is also thickened and retracted; but the thickening is generally unequal, and there are always visible signs of old inflammatory action, such as white chalky deposits of old exudation, and in old-standing cases thinning of parts of the membrane, the atrophic areas being dark in colour. This wasting of the membrane may become so marked that the contents of the tympanum can be distinguished through the membrane—the long process of the incus, the crura of the stapes, the niche of the fenestra rotunda, and even—though rarely—the chorda tympani nerve as it crosses between the malleus and incus close to the upper limit of the membrane. These cases are always

associated with catarrh of the nose and throat, and are generally secondary to it—hence the term ' throat-deafness.'

In yet a third group of cases there is slowly progressive deafness without any history of pain or discharge, but almost always with a history of early and persistent tinnitus, which often distresses the patient much more than the deafness. On inspection the membrana tympani is seen to present a beautifully normal appearance, varied in some cases by a slight pinkish tinge shining through from the promontory, and in others by an abnormal whiteness and clearness of outline of the manubrium and short process of the malleus. The nose, throat, and Eustachian tubes (in a pure case) are absolutely normal, and the tuning-fork signs are those of middle-ear deafness. Such cases are due to a true sclerosis of the middle ear—that is to say, to a deposit of new bone in some part of the capsule of the labyrinth, frequently on the inner wall of the tympanum in the region of the fenestræ and niche. There are thus three well-marked kinds of painless progressive deafness associated with definite changes in the middle ear and adjacent parts :

1. Hyperplasia, frequently with Eustachian obstruction.
2. Catarrh, with Eustachian obstruction.
3. Sclerosis.

Mixed cases are common, and the signs of secondary nerve-deafness are often superadded in the later stages. Scars in the membrane appear dark in colour, and are only distinguishable from atrophic patches by the fact that the scar has a more definite outline. Scars, however, only occur after injury or suppuration. It is usual to regard the second class of cases as chronic aural

catarrh, and no doubt in many of them there is a genuine catarrhal process in the middle ear and Eustachian tube ; but in a very considerable number the aural changes are not really catarrhal, but are entirely secondary, due to the Eustachian obstruction with which catarrhal conditions of the nose and throat are so often associated. Many cases are traceable to the presence of adenoid growths in childhood and youth, and in such both the obstructive and the catarrhal elements may be present.

Changes in the vascularity of the membrane are frequent, and when slight are generally limited to the arteries of the hammer and the parts about Schrapnell's membrane. When the hyperæmia is more pronounced the landmarks very soon become blurred, and in a bad case they are completely obliterated, the deeper part of the meatus sharing in the congestion, so that it is quite impossible to say where meatus ends and membrane begins.

In addition to increased vascularity and associated with it, swellings of the membrana tympani will often be seen in cases of otitis. Rounded bulgings of the posterior and upper quadrant are especially frequent, and when the adjacent part of the meatus participates in the bulging it may be assumed with great probability that there is pus in the mastoid antrum. The handle of the malleus soon becomes indistinguishable, but the position of the short process can often be made out after the manubrium has disappeared. Such extreme hyperæmia is seen in its most typical form in acute otitis, in which the Eustachian tube, middle ear, mastoid cells, and deeper part of the meatus are all involved. As the process subsides, after the stage of exudation has passed, individual vessels again become distinguishable, radiat-

ing sometimes from the umbo to the circumference of the membrane like the spokes of a wheel.

In recent moist catarrhs without suppuration there is often no noticeable hyperæmia, but the surface of the membrane presents a peculiarly smooth shining appear- ance—almost as if it had been varnished—and exudation can sometimes be seen filling the lower part of the tym- panum, and forming a dark line across the membrane. In such a case air-bubbles may be seen after inflation, and when the exudation is thin it may change its position as the head is moved. It is usual in text-books to de- scribe acute and chronic inflammation affecting the membrana tympani alone without involvement of the middle ear. Such conditions do certainly occur, but they rarely come under observation, and are practically unimportant, not being attended with serious disturb- ance of health or function. As a rule intense injection of the membrane indicates an acute otitis, in which tube, tympanum, mastoid, and bony meatus are all in- volved, and the general symptoms are pronounced and unmistakable.

In a case of acute earache, with considerable pain and feverishness, the student may sometimes be in doubt as to whether he has to do with an inflammation of the tympanum or only of the deeper part of the meatus. Inflammation of the meatus alone does not give rise to deafness, except indirectly, by blocking the passage with the products of inflammation; but an otitis media is from the first attended by some deafness, which becomes pronounced as soon as the stage of exudation begins. It must, of course, be remembered that both conditions may be present simultaneously. In either case, the picture seen through the speculum changes very much as the stage of exudation comes on, and the

meatus becomes filled with inflammatory products— white and sodden epidermis, loose scales, liquid exuda- tion, and pus. As the inflammation subsides the familiar landmarks gradually reappear. During active suppuration the view through the aural speculum is apt to be very puzzling. After carefully cleaning and drying the ear, the student sees, perhaps, a somewhat irregular surface covered by granulations; but there are no familiar landmarks, and he cannot make out whether he is looking at the outer surface of the membrana tympani or at the inner wall of the middle ear, or at a picture composed of parts of both regions. Practice alone will enable him to interpret accurately what he sees ; but an accurate knowledge of the normal topography of the outer and inner walls of the middle ear is absolutely essential before he can hope to make any progress at all.

The presence or absence of a perforation is a point upon which patients often desire a definite opinion. A perforation may be quite evident, and appear as a little black hole in the membrane, or it may be larger, and show the red smooth or granular surface of the mucous membrane of the promontory ; or, again, there may be no visible hole, but a pouting granulation, with, perhaps, a trickling stream of pus proceeding from it, may suffici- ently indicate the state of affairs.

Perforations in Schrapnell's membrane are found most frequently just above the short process of the malleus. They are generally small, there is little dis- charge, and the rest of the membrane is dull and re- tracted. A large perforation in this region is sometimes associated with considerable destruction of the adjacent bone, including the inner part of the roof of the meatus, the ' outer wall of the attic.' In this way the attic may be exposed to view, with the head of the malleus and

body of the incus, when these ossicles are still present ; generally they have been destroyed. This removal by nature of the outer wall of the attic leads at times to the cure of a chronic suppuration, but in probably every case relapses occur.

When no perforation is to be seen an inflation of the middle ear by Politzer's method, or through the catheter, will generally settle the question of whether one is present or not. The noise of air whistling through a small perforation is unmistakable, but in the case of a larger one there may be no whistling sound, and it is well to use the auscultation tube. When exudation is present air-bubbles may appear in it after inflation ; or the meatus may be filled with warm water and the head inclined over with the ear to be tested uppermost, when air-bubbles will rise to the surface of the water if the inflation goes through.

Very frequently in chronic suppurative otitis media masses of granulation tissue fill the deeper part of the meatus and obscure the field. A granulation mass growing outwards from the tympanum may fill the whole passage and present at the meatus as an aural polypus, with, in old cases, a well-marked epidermal covering. All such growths must be removed before a really accurate diagnosis can be made or any progress made with treatment.

When there is a bulging of the posterior and upper wall of the meatus close to the drumhead, suppuration in the antrum is almost certainly present. When the membrana tympani is extensively destroyed a very complete view of the inner wall of the middle ear may be obtained as soon as active suppuration has ceased. The little round white head of the stapes and the dark gap of the niche leading to the fenestra rotunda are the

two most prominent landmarks in such cases, but the
dark opening of the Eustachian tube may also some-
times be seen at the very front, when the anterior wall
of the meatus is not markedly convex.

When the membrane is less extensively destroyed it
is very common to find some remains of the handle of
the malleus, generally a stump, extending some distance
below the short process, and often adherent to the inner
wall. The ring of membrane which has escaped is, of
course, attached to this stump, and the central edges
of the ring are generally adherent, more or less, to the
inner wall of the tympanum.

Sometimes the edges of a perforation become adherent
to the promontory during the process of healing—especi-
ally if inflation through the Eustachian tube be neglected
—and from the adherent edges of the perforation a
thin and delicate layer of cicatricial tissue spreads over
the gap, covering the promontory, but so thin and trans-
parent that the eye cannot detect its presence. The
writer recently encountered a case of this kind while it
was still comparatively recent, and was able by vigorous
inflation to free the adherent membrane and restore the
hearing practically to a normal standard. A thin dark
central cicatrix became apparent in the membrane as
soon as it was freed, and the promontory, which had
been plainly visible through the transparent cicatricial
tissue as long as the two structures were in close con-
tact, disappeared as soon as the natural interval between
the membrane and the inner wall was restored. Cica-
trices are extremely thin as compared with the normal
membrana tympani ; they have been aptly compared
to gold-beaters' skin, and they yield and stretch readily
before any increase of air-pressure. Thus, a non-
adherent cicatrix often comes to form a pouch which

bulges outwards towards the meatus or inwards to-
wards the tympanum, according to the variations in
the air-pressure. When Siegel's speculum is applied
such a scar may be seen flapping about freely.

Adhesions may form at almost any point, but the
parts of the inner wall of the tympanum which are
most frequently covered by a layer of thin cicatricial
tissue belonging to the membrane and spreading from
its remains are the promontory, and the posterior upper
quadrant, which, as we have seen, contains most of
the landmarks—the incudo-stapedial joint, the tendon
of the stapedius, the chorda tympani, and the greater
part of the niche of the round window. Irregular
pockets are sometimes formed between the inner wall
of the tympanum and cicatricial adhesions, and such
pockets may form the seats of troublesome suppuration.
Again, when there is a large perforation in front of the
malleus, the part of the membrane in front of the per-
foration may contract adhesions to the adjacent pro-
montory across the mouth of the Eustachian tube, which
is thus shut off from the tympanic cavity. Inspection,
careful palpation with a probe, inflation through the
Eustachian tube, and the use of Siegel's suction speculum,
are the means to be used for the precise diagnosis of
adhesive and cicatricial processes.

When a suppurating ear is neglected and the drainage
insufficient, the parts surrounding the middle ear are apt
to become involved. This extension of disease may take
place in any direction.

1. **Backwards** into the antrum and mastoid pro-
cess, causing the formation of an abscess, which may be
subperiosteal, or situated in the substance of the bone.
In the latter case, if untreated, the pus will probably
break through the bone internally, in the region of the

sigmoid sinus groove, and externally through the
mastoid cortex.   In the acute mastoiditis which follows
influenza it is not uncommon to find the pus lying
between the skin and the dura mater where it forms the
sinus wall, having broken through in both directions.
As the sigmoid sinus lies in contact with the cerebellum,
the risks of sigmoid thrombosis and cerebellar abscess
are obvious.

2. **Extension upwards** through the tegmen tympani
or antri is less frequent, but it is important as being
the route followed by the infection, which leads to
temporo-sphenoidal abscess.

3. **Extension inwards** involves the internal ear,
and often the first sign of it is the appearance of facial
paralysis.   When the infection reaches the internal
auditory meatus it generally gives rise to meningitis.

4. **Extension forwards** is not common.   It may
take place by way of the Glaserian fissure or the
Eustachian tube.   In children the fissure is patent,
and pus may find its way through it to the glenoid fossa
and parotid region.   When the Eustachian tube is
blocked, abscess of that structure may occur, leading
to its disintegration, the separation of the bony from
the cartilaginous part, and the burrowing of pus down-
wards under the mucous membrane of the naso-pharynx
and soft palate, or even as far as the side of the neck.
This, however, is a very rare complication.

5. **Extension outwards** is generally prevented by
the freedom of drainage through the meatus, but when
from any cause (swelling, granulations, polypus) it
becomes blocked so that irritating septic pus is retained
in the passage, ulceration and sloughing may ensue with
disastrous results.

The writer recently had a case of this description

in which the pus had separated the bony from the cartilaginous meatus, and burrowed under the deep fascia, causing a large phlegmonous swelling below the mastoid involving the facial nerve, and a condition of gangrenous cellulitis extending considerably below the angle of the jaw. There was also a sloughing cavity under the parotid fascia, the pus having apparently found its way through the fissures of Santorini in the anterior wall of the cartilaginous meatus.

6. **Extension downwards** may affect the jugular bulb, which lies just below the floor of the tympanum. The existence of physiological gaps in this floor is not apparently (Politzer) a very rare occurrence, and exposes the bulb to risk of injury and septic infection. Apart from such physiological defects caries or necrosis of the floor is liable to cause septic thrombosis of the bulb. The internal carotid artery, which runs through the pars petrosa in front of and below the tympanum, is exposed to the risk of ulceration in the same way.

The pouring of strong corrosives into the ear with a view to escape military service has several times resulted in ulceration of the carotid. Some of the recorded cases died of pyæmia, others of hæmorrhage ; none recovered.

9

HINTS ON LOCAL TREATMENT

The Mouth and Pharynx.

Gargles are suitable for chronic and subacute con-
ditions. When the fauces are acutely inflamed the
muscular action involved in gargling is painful and
injurious, and as the contact of a gargle with the in-
flamed parts is comparatively brief, the disturbance
does more harm than the gargle does good.

Sprays are very useful for acutely inflamed throats.
The spray should be a fairly coarse one, similar to that
used for the nares. The same drugs are used as in
gargles, and of the same strength.

Paints should, when possible, be prepared with
glycerine, which sticks to the mucous membrane, and
so retains the drug in contact with it. Carbolic, boracic,
and tannic acids, and iodine (Mandl's solution) may be
applied in this way, and also the perchlorides of mercury
(1 in 300) and iron (3i. to 3i.).

Caustic paints, such as nitrate of silver (60 gr. to 3i.)
and chromic acid (24 gr. to 3i.), are used in watery
solution.

Paints are applied with a brush of absorbent cotton
wound on to a cotton carrier. The best cotton carrier is
a piece of stout wire, about as thick as a steel knitting-

needle, fairly rigid, yet capable of being bent, and filed
square or triangular for an inch at the end so that a thin
layer of absorbent wool can be quickly and securely
wound on to it, and yet can be easily pulled off after
use. German silver wire answers very well. The cotton
carrier should be fixed by a retaining screw in a handle
similar to that used for the laryngeal mirror. The
handle is convenient for use, and also to give purchase

FIG. 32.—BRUSH OF ABSORBENT WOOL ON A LARYNGEAL
COTTON CARRIER.

in winding the cotton firmly and smoothly round the
carrier. A well-made brush is conical, and projects
with its base beyond the wire, which is thus safely
buried in the middle of it. The brush may easily be
made of any degree of looseness or firmness, according as
it is desired to apply paint to a large surface, or caustic
to a small surface, or to mop up blood or secretion.

Strong caustic pigments, such as lactic and tri-

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chloracetic acids (saturated solutions) or nitrate of
silver (Ʒi. to Ʒii. to Ʒi.), are only applied as a rule to
comparatively limited areas, and the application
should be made, not by brushing, but rather by
' dabbing,' or pressing the end of the brush lightly
against the surface to be cauterized. The brush must
not be heavily loaded or the caustic will run. A brisk
shake before using will get rid of superfluous liquid.
Attention to such little details—apparently trivial—
makes a considerable difference in the amount of dis-
comfort inflicted by these measures of local treatment,
and most patients are quite intelligent enough to appre-
ciate the advantage of an application made with care
and precision under good illumination. It causes
much less discomfort, and it is also more effectual than
a random application.

To cocainize any particular part of the mouth or
pharynx the anæsthetic should be briskly rubbed in
with a brush of absorbent cotton soaked in a 10 per
cent. solution. Two such applications at intervals of
two or three minutes suffice for most purposes—*e.g.*,
tonsillotomy, or the application of the galvano-cautery.
When the parts are acutely inflamed, as in peritonsillitis,
one rests content, perforce, with the use of a spray.

The Naso - Pharynx.—Remedies are applied to
the naso-pharynx through the nares and through the
mouth. The former route is chosen for the application
of lotions or washes, and the latter, as a rule, is utilized
for pigments and sprays.

A stout cotton carrier, bent at a right angle about an
inch from the end, is required for the application of
paints through the mouth. When the nose is atrophic
a straight brush can be passed more conveniently
through the nares. Watery or oily solutions may be

applied to the naso-pharynx by means of the post-
nasal spray. A convenient form of instrument for this
purpose is the De Vilbiss No. 4, in which the nozzle is
movable, so that the jet may be directed upwards into
the naso-pharynx, or downwards into the larynx, or
backwards to the posterior pharyngeal wall. Spraying
is not a powerful means of treatment in this region, but
it is sometimes a useful adjuvant. Oily solutions are
generally preferable to watery ones.

When the nasal passages are free the naso-pharynx
may be partially anæsthetized very easily by spraying
a few drops of cocain solution through the nares, but
when complete anæsthesia is desired it is necessary to
brush the parts thoroughly, and particular care should
be taken that the brush contain no excess of cocain,
as every drop that runs down inevitably finds its way
into the stomach. This caution applies to every appli-
cation of cocain ; all excess of the drug should be
squeezed out of the cotton, leaving it thoroughly moist,
but incapable of dripping.

Nasal Washes.—The nasal mucosa is extremely
sensitive and intolerant of irritants, and local appli-
cations to the general surface should always be of the
blandest description. Borax is the most suitable
antiseptic for general use, and it may with advantage
be combined with bicarbonate of soda and common
salt in equal proportions. In powder form this formula
tends to deliquesce, so that it is best prescribed in the
form of tablets ; but if large quantities of lotion are
required, as for irrigation, it is more convenient to
omit the salt and prescribe equal parts of borax and
bicarbonate of soda in powder form. This keeps
perfectly, and one teaspoonful to a tumblerful of
warm water makes a suitable lotion. Small quantities

of other antiseptics may be added if desired—*e.g.*, a grain of carbolic acid to the ounce, or a teaspoonful of Sanitas fluid to the pint. Normal saline solution is another excellent wash.

The lotion may be applied in various ways :

1. Sniffing up from the palm of the hand or from a suitable vessel. This is an excellent method for cases in which there is not much crusting, nor copious secretion. The lotion follows the natural course of the inspiratory air-stream, and most patients readily acquire the knack.

2. Another simple method is to use a little glass tube holding about 2 drachms (a tabloid sample tube answers very well). The tube is filled with warm lotion, and while the patient breathes out and in through the mouth with the head inclined backwards, the tube is inserted into the opening of the nostril and tilted up so that the lotion runs down the nostril into the naso-pharynx. Here it can be made to wash from side to side by inclining the head laterally, and if the anterior nares be then closed with the finger and thumb and the head bent well downwards, the lotion flows into the anterior ethmoidal region about the hiatus and infundibulum, and loosens any secretion that may be lying under cover of the middle turbinal. This process may be repeated half a dozen times, or as often as may be desired. From personal experience the writer can recommend this method as simple and efficient, suitable for the same class of cases as ' sniffing up.'

3. In cases with copious secretion and perhaps soft crusting, Pius' douche on the principle of the chemical wash-bottle is very suitable, and as the patient herself blows the lotion through there is no possibility of any of it getting into the throat.

4. For all cases with much crusting the modification of Higginson's syringe, known as Wingrave's, is the best. The patient (or surgeon) can direct the stream in any desired direction, and a large quantity of lotion can be used.

In order to irrigate the ethmoidal region the nozzle of the syringe should be introduced about an inch into the nostril, pointing upwards and backwards towards the tip of the auricle. The stream is thus directed towards the spheno-ethmoidal recess, the upper and posterior corner of the nasal cavity where the roof and posterior wall join, and if the head be inclined forward the return stream flows almost entirely by the anterior naris. The patient should, of course, hold the mouth open during the irrigation, and breathe quickly out and in.

Anterior Nasal Spray.—A coarse spray is some-times used for cleansing purposes, but it offers no advantage over other methods.

A very fine spray or vaporizer is used with liquid paraffin, either alone or medicated with various drugs. In irritable conditions of the nasal mucosa only the very blandest applications will be tolerated, and the spray must be of the very finest in order to avoid the irritation caused by the impact of particles on the sensitive surface. The vaporizer known as De Vilbiss No. 0 is very suitable in such cases, but when the nose is not irritable a coarser spray is to be preferred, as it coats the surface better.

Powders may be applied to the nasal mucosa either by sniffing up or by blowing through a tube. Snuffs are chiefly sedative (Ferrier's) and stimulant (menthol, 2 to 3 per cent.), whilst the insufflator is used for blowing antiseptic powders on to the raw surfaces which are left

after various operations, such as turbinectomy, removal
of polypi, etc.   Iodol and aristol are used in this way,
either pure or diluted with equal parts of a neutral
powder such as sugar of milk.   Sulphur is applied pure,
sublimed or precipitated, and acts admirably as a
painless styptic, caustic, and antiseptic.

To Cocainize the Nose. — 1. For purposes of
examination, passing the Eustachian catheter, etc.,
the simplest plan is to spray a few drops of cocain and
adrenalin solution into the nostril.   The writer uses a
solution of cocain (5 to 10 per cent.) containing 5 per
cent. of resorcin as recommended by Sir Felix Semon.
This solution keeps well, and the resorcin does not
irritate, although it slightly whitens the nasal mucous
membrane.

2. To anæsthetize thoroughly any particular part it
should be as far as possible enveloped in a layer of
absorbent wool soaked in 10 per cent. cocain solution,
with the addition of 10 per cent. adrenalin chloride
solution.   The pledget of wool should be thoroughly
moistened, but no more, otherwise when pressed into
position some of the cocain is squeezed out and runs
down into the throat, causing the patient considerable
needless discomfort, and sometimes giving rise to toxic
symptoms.   In from five to ten minutes the part will be
bleached and quite insensitive.   Even the division of
the spongy bones with snare, scissors, or punch forceps
may often be accomplished painlessly when it has been
possible to reach the parts thoroughly with the cocain
solution.   An unpleasant crunching sensation is com-
plained of as the bone is cut.

Plugging the Nose.—When a reflector, a specu-
lum, and a good light are available it is almost always
possible to localize the source of the hæmorrhage

sufficiently to enable one to apply a plug locally, with-
out filling the entire cavity with gauze or lint.   The first
thing is to clear away all clots, and then—as in the case
of bleeding from any wound—by mopping and inspecting
the cavity instantly the mop is withdrawn the actual
bleeding-point, or at least the region in which it lies,
can generally be made out by anyone who is familiar
with nasal topography *in vivo*.   Spontaneous epistaxis
proceeds in about 90 per cent. of the cases from the
' bleeding spot ' at the anterior and lower part of the
septum, and this is a region which is easily reached by
a compress of antiseptic gauze or lint, or absorbent wool
soaked in peroxide of hydrogen.

The bleeding from nasal operations is free, but, as a
rule, it soon ceases spontaneously.   So experienced an
operator as Dr. Lambert Lack rarely finds it necessary
to plug the nose, even after extensive operations on the
ethmoid.

After slight nasal operations, such as partial turbin-
ectomy or removal of polypi, plugging is rarely necessary
if the patients remain under observation ; but in the case
of persons returning home some distance, and perhaps
living in the country, the writer invariably applies a
compress of antiseptic gauze to the cut surface, and
instructs the patient to remove it next morning.

After removal of the operculum, the cut surface of
the middle spongy bone looks downwards and forwards
towards the anterior naris, and a compress can be easily
applied to its whole length.   In more extensive eth-
moidal operations, such as removing the whole of the
middle turbinal and opening the posterior cells, the
whole ethmoidal region may require packing for some
hours—six to twelve is generally sufficient.   In such a
case the gauze should be packed upwards and back-

wards towards the top of the auricle, so as to reach the upper and posterior corner of the nasal cavity between the choanal arch and the roof of the nose. Cyanide gauze in ribbon form makes an excellent plug.

Plugging the posterior nares is a proceeding which is hardly ever necessary when the surgeon has facilities for examining the cavity, and is able to take advantage of them ; but in certain rare cases of bleeding from the neighbourhood of the choanal arch, the posterior plug may be the readiest means of control.

Cooper Rose's inflating plug is a useful contrivance which may be applied in bleeding from almost any part of the nasal cavity, and its application requires no special skill, and can do no harm. The writer has seen considerable sloughing, adhesions, and facial erysipelas result from forcible unskilled plugging with gauze or lint.

The Nasal Snare (Cold Wire).—Snares may be divided into two classes : (1) Those in which the barrel is quite open at the end, so that the wire loop can be pulled right through it, thus cutting off completely any included tissue ; (2) those in which the end of the barrel is crossed by a bar or partition, which prevents the wire from being drawn through. With an instrument of this sort any included tissue is constricted by the wire till it forms a kind of pedicle, which is then pulled off. In a modification of this second form the barrel ends in a loop, so that the same loop of wire can be used again and again.* This is the most useful snare for the removal of polypi from the wider parts of the nose, but it cannot be inserted into a narrow cleft. The most comfortable handle is the one with three rings, for the thumb and two first fingers. It is convenient in

* Thorne's snare.

threading a snare to arrange that the wire loop shall lie
horizontally, as that is the position in which it will be
when adjusted round a polypus or other growth. As a
rule, the wires of the loop are introduced placed vertically
as regards each other, parallel to the septum and close to
it. Before using a snare it is well to see that the wire
loop is *not too long to be pulled home,* otherwise the oper-
ator may find his snare anchored fast to a mass of tissue
which he cannot divide, and from which he may find
it difficult to release it. This may seem a superfluous
precaution, but the writer has seen it happen repeatedly
in hospital practice where the snares are generally pre-
pared by a nurse or porter. A screw adjustment that
can be tightened gradually is occasionally desirable in
the case of vascular growths. Lack's instrument is
provided with both the pull and the screw adjustment.

The cold wire snare is the instrument *par excellence*
for the removal of polypi and hypertrophies, with the
single exception of the choanal polypus, which is more
easily removed with forceps guided by the finger in the
naso-pharynx. It is sometimes said that anything
which can be removed from the nose with the snare is
abnormal, and ought to be removed. Speaking gener-
ally, this is true, but the head of the middle turbinal
must be excepted, for it is not infrequently so shaped
that a considerable section of it can be removed with the
snare in a perfectly normal nose.

The Nasal Saw is used chiefly for removing ridges
from the septum. The blade should be narrow enough
to fit in below the ridge and saw upwards, and the
metal of which it is made should be thick enough for
rigidity. The cross-cut pattern is a good one, and
cuts rapidly, which is important. Two blades fit the
same handle.

Nasal Scissors.—The most generally useful pattern is Panzer's, which is curved on the flat. The points are best slghtly rounded.

Punch Forceps, or Conchotome, are extremely useful for removing portions of the middle and lower turbinals. It is important that both blades be fenestrated in order that the instrument may clear itself of the excised pieces of tissue as it is worked. The original Grünwald's forceps had solid blades, and so could not be worked continuously, but had to be frequently withdrawn in order to clear the lower blade of bits of tissue. This was a serious disadvantage.

The Ring-Knife is, in the writer's opinion, vastly superior to the sharp spoon in the nose. The best pattern is Hartmann's, in which the back of the ring is blunt, and the edge is inclined to the shaft at a slight angle. It is an extremely useful instrument, but is capable if injudiciously used of doing enormous harm.

Caustics.—Trichloracetic and chromic acids are those most suitable for use in the nose. The former coats the surface with a white protective pellicle, and is a useful astringent and caustic application to inflamed and hyperæsthetic areas ; the latter exerts a more powerful destructive action, and is suitable for cases of slight hypertrophy with profuse secretion. It is actively poisonous when swallowed. Both may be applied by means of the same instrument—the chromic acid carrier —and a saturated solution is more easily manipulated than the pure crystals.

The Galvano-cautery is employed for the destruction of redundant tissue which cannot be conveniently removed by other means, such as the snare or the punch forceps. In the throat the hypertrophy is generally

lymphoid.   The burner should be used at a bright red
heat ; it is applied cold, and by pressing a trigger the
current is turned on.   The beginner is more apt to do
too little than too much ; he must carefully avoid the
pillars of the fauces.   In the nose it is applied chiefly
to the anterior part of the lower turbinated body for
the purpose of reducing moderate thickening, or of
binding down the engorged erectile tissue to the bone
by cicatricial contraction.   Sessile enlargements of the
soft parts of the septum are conveniently reduced by
it, but the writer almost never applies it to any part of
the ethmoid, believing that redundant tissues in that
region are best and most cleanly removed by the snare,
the punch forceps, or the ring-knife.

The Larynx.

For the inhalation of volatile remedies, such as
benzoin, carbolic acid, menthol, and chloroform, many
forms of inhaler are sold, but a common pint or quart
jug answers the purpose very well, and it is always at
hand, or can be easily obtained.   A towel folded length-
wise to about the breadth of the hand is folded round
the top of the jug so as to form a sort of mask, to include
the mouth or nose, or both, as the case may be.

The laryngeal spray has been already alluded to.
Oily liquids (paraffin. fluid., ' paroleine,' etc.) are upon
the whole the most effectual, and menthol ($2\frac{1}{2}$ to 5 per
cent.) is perhaps the most useful drug, but it may be
combined with others, such as cocain and morphia, if
desired.   The laryngeal syringe is used chiefly for the
injection of oily liquids containing menthol ($2\frac{1}{2}$ to 5 per
cent.), guaiacol (25 to 50 per cent.), etc., in solution.
It is an excellent palliative method in some cases of

laryngeal tuberculosis, and in the secondary laryngitis
due to ' ozæna ' or nasal suppuration.

Paints are more powerful both for good and evil
in the larynx than inhalations, sprays, or injections.
They are applied with a cotton brush firmly attached
to a curved carrier. In order that the brush may be
secure, the cotton must be tightly wound round the wire
at the upper part of the brush, and it is well to test it
before use (Fig. 32).

A brush introduced into the larynx without the pre-
vious application of cocain probably rarely penetrates
beyond the false cords. The larynx closes instantly
round the foreign body, and squeezes out of it some of
the liquid with which it is charged. A forcible cough
announces the fact that the larynx has been entered.
Cocain is best applied with a cotton brush to the interior
of the larynx. For complete anæsthesia the writer
uses a 20 per cent. solution applied at intervals of two
or three minutes. Three applications generally suffice,
and brisk friction should be used, particular attention
being paid to the posterior surface of the epiglottis.

Powders are blown into the larynx through a suitably
curved tube. Morphine (diluted with sugar of milk),
orthoform and resorcin (equal parts), alum, and calomel
are examples of remedies so employed. The tube may be
either of glass or metal, and in the best instruments the
charge is released by simply pressing a button or trigger,
without disturbing the operator's aim. A strong blast
of air should never be used, as it is very apt to induce
distressing spasm of the glottis.

With regard to the more active forms of local treat-
ment of the larynx, it must be remarked, in conclusion,
that it is very easy to overdo them.

The Ear.

Otorrhœa. — The object of all local treatment,
whether the discharge proceed from the meatus or
from the middle ear and its accessory cavities, is to keep
the parts clean and dry. Much of the difficulty
experienced in treating suppurative otitis is due to the
fact that the seat of disease lies out of sight at the end
of a curved passage about 1¼ inches in length. This
makes the middle-ear spaces difficult of access, and
causes their diseases to be easily overlooked. If the
tympanum lay close to the surface no special skill
would be necessary in applying ordinary surgical
principles to the treatment of its diseases, or in knowing
when to apply them. Hence the great importance,
already insisted upon, of mastering the use of reflected
light and the methods of examination.

In suppurative diseases the middle-ear spaces drain
externally through the meatus, and internally through
the Eustachian tube into the naso-pharynx. In a
great majority of cases this drainage is sufficient, or
can be made so by the use of simple methods, such
as inflation, the use of Siegel's suction speculum, the
enlargement of a small perforation, the removal of
obstructing growths and granulations, or, if need be,
of ossicles, and, in addition, attending to the mucous
membrane of the throat and nose so as to make the
Eustachian tube more pervious. When these simple
methods do not suffice, aided by diligent irrigation
through the meatus, and, if necessary, through the
Eustachian tube, drainage must be provided by other
means.

In acute cases, of which influenza furnishes many
examples, it is usually sufficient to open the mastoid

cells or antrum—one or both, as the case may be—for
there is no doubt that in a good many cases the infection
passes into the mastoid (superficial) cells, and is there
sealed up, whilst the antrum and tympanum undergo
spontaneous recovery. In acute cases then drainage can
be provided by opening the antrum or the cells; or both
if there is any doubt in the matter. In chronic cases,
however, and in acute attacks supervening on a chronic
discharge this is not sufficient. The middle-ear spaces are
often packed with fœtid, caseous, or cholesteatomatous
masses, and a much more extensive operation is neces-
sary in order to remove diseased bone and provide free
drainage. Into the details of the operation this is not
the place to enter, but it consists in effect in (1) opening
the mastoid antrum; (2) cutting away the posterior wall
and part of the roof of the bony meatus, including the
outer wall of the attic; (3) removing all diseased
tissues, soft and hard; (4) splitting the membranous and
cartilaginous meatus, suturing the post-aural wound,
and packing the cavity through the split meatus.
When performed with care and thoroughness this
operation gives excellent results, and a very fair amount
of hearing-power is frequently retained. Patients are
too frequently left till cerebral symptoms supervene, or
till the occurrence of facial paralysis draws attention to
the extension of the disease. The nerve is most liable
to be affected in the deeper part of its course, and the
occurrence of paralysis frequently indicates the exten-
sion of bone disease to the internal ear, a situation in
which it may be beyond the reach of operative treat-
ment.

   Irrigation of the Ear is best performed with a
Wingrave's syringe, which is just an ordinary Higginson
made with the ball placed close to the nozzle, which is fine

and suitable for aural use. Dilute antiseptics are used in irrigating. Boracic acid (ʒi. to Oi.) is suitable for the ear, and 1 or 2 pints should be injected at each sitting.

For syringing in ordinary cases where irrigation is not required a glass syringe holding about 1½ to 2 ounces is suitable. The plunger should be of rubber. Such a syringe costs about a shilling, and answers just as well as a more expensive one.

Ear-Drops should not be introduced till all discharge has been removed by mopping or syringing. The patient should lie down with the ear to be treated uppermost, and the drops are poured into the meatus. When there is a small perforation it is a good plan to inflate while the patient is recumbent. Secretion is blown out of the tympanum and the lotion passes in. The patient should remain lying for four or five minutes.

A great variety of astringent and antiseptic substances are employed as ear-drops. Peroxide of hydrogen is most useful in cleaning the ear, decomposing pus and blood, and loosening accumulations of epidermal scales. It may be poured in freely, cold, and left in till effer-vescence has ceased. Drops containing alcohol are very useful for checking the growth of exuberant granulations. Methylated spirit answers the purpose just as well as pure spirit, and it may be diluted to any extent desired— 25 to 50 or 75 per cent. strength. Pain should not be caused by these drops, nothing more than a transient burning sensation. A favourite plan of the writer's is to use peroxide of hydrogen first, and then, after washing out any débris, to instil alcohol drops of a suitable strength containing boracic acid in solution.

Powders are blown into the ear in cases of otorrhœa after the parts have been cleaned and dried. Boracic

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acid is generally employed, and the method is suitable for cases in which there is free drainage (large perforation) and moderate discharge.

Wylde's Snare threaded with soft iron wire is used to remove masses of granulations and polypi from the meatus and tympanum ; piano wire may be occasionally required for firm polypi, but as a rule it is unsuitable on account of its stiffness and resiliency. The very qualities which make it so valuable in the nose render it unsuitable for ear work.

A slightly curved curette known as Barker's is convenient for removing granulations from the ear when they cannot be encircled by the loop of a snare. The curette causes much more pain than the snare, however, and gas or ethyl chloride anæsthesia is generally desirable. When this is not available chromic acid may be used. It is the best caustic for the purpose.

Local anæsthesia in the ear is not so satisfactory as in the nose and throat. A warm saturated solution of eucain answers fairly well when there is a moderately large perforation of the membrane, and it is not liable to cause toxic symptoms as cocain may do by finding its way down the Eustachian tube into the throat.

When there is no perforation a partial anæsthesia may be procured by inserting a pledget of wool soaked in a mixture of carbolic acid, menthol, and cocain, of each gr. v. to ʒi. of glycerine, and leaving it in position for ten to fifteen minutes.

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THE END